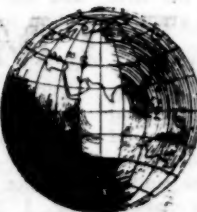


Current Science



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INTERNATIONAL LABORATORIES FOR RESEARCH

THE spirit of science being in the truest sense international, co-operation among scientists in different countries is no doubt the condition essential for progress. But it would appear that such co-operation as exists today among scientists by way of free exchange of ideas and information pertaining to research, is hardly enough. For, there have emerged research projects in many branches of science which are well beyond the resources of any one country to put through. We have, in fact, lighted on an era in science when several countries may have to pool together their resources for the creation of Central Laboratories to carry out these special programmes of research. It is, therefore, very gratifying to learn that the UNESCO have taken some pioneering steps in the formation of such international centres of research. The details of the historical picture leading to these developments are indeed worth recording.

The basic aspects of this problem were studied, following the decision of the Economic and Social Council in 1946 inviting the Secretary-General of the United Nations, Research

Laboratories. An extensive enquiry was made by the Secretary-General, and in 1949 a Committee of Experts from the UNESCO and the United Nations examined the results of this enquiry and recommended the following priorities in the field of natural sciences: first priority—computation centre, brain institute; second priority—astronomical laboratory, institute of biochemistry, meteorological Institute, research laboratory on arid zones.

The convention for the setting up of the International Computation Centre, comprising three main functions in the fields of research, education and service, was signed on the 6th December 1951, by eight countries: Belgium, Egypt, Iraq, Israel, Japan, Mexico and Turkey. There were several offers from the member-States of the UNESCO for the location of the Centre, and it was decided to establish the Centre in Rome, where the Italian Government offered a wing of its National Research Council building, and agreed to lend the Centre \$75,000 free of interest for ten years. All the library and documentation facilities of the National Research Council have been placed at

the disposal of the Centre whose annual budget of \$ 100,000 is to be made up from the contributions of its member-States. For the first year, UNESCO will give the Centre a grant of \$ 15,000 and a loan of \$ 60,000.

As a result of the co-operation offered by the European States, there has been another promising development towards international collaboration. At the General Conference of the UNESCO in Florence in June 1950, Professor I. I. Rabi proposed on behalf of the United States delegation that UNESCO should make a preliminary study of the possibility of setting up a West European Physics Laboratory for High Energy Particles. Professor Pierre Auger, Director of the Department of Natural Sciences of the UNESCO, submitted a report and it was discussed by a Committee of Experts convened by the UNESCO.

A conference of about 60 delegates from 12 European countries examined the plan prepared by the UNESCO in regard to the equipment and structure of the Laboratory, the creation of an Institute for Advanced Studies in Nuclear Research, the organization of the work including the creation of study groups in various countries and liaison with the governments taking part in the work. It also estimated the cost of studies to be undertaken during 1952 and considered the establishment of the list of States willing to participate in the work and the calculation of their financial contributions. Following another meeting in February 1952, a Council of Representatives has been set up with

Headquarters in Geneva which will be responsible for the establishment of the Laboratory and the organization of other forms of co-operation in nuclear research.

Twelve States have signed the agreement constituting the Council. The Secretary of the Council is Professor E. Amaldi (Italy). The heads of the study groups are: construction of a synchro-cyclotron for energies of at least 500 Mev—Professor C. J. Baker (Holland); construction of a cosmotron with energy exceeding 1 Bev.—Professor O. Dahl (Norway); organization of an International laboratory for nuclear research—Dr. L. Kowarski (France); theoretical studies to be set up in Copenhagen—Professor Niels Bohr (Denmark). Without prejudice to the ultimate location of the laboratory, the synchro-cyclotron of the University of Liverpool of 400 Mev will be made available for work on an international basis during 1952.

Examples such as the above are well worthy of emulation by comparatively under-developed countries like ours. Nations occupying contiguous areas can advantageously co-operate in establishing common centres of research on problems of mutual interest, thus avoiding the unnecessary expense in duplication. It is to be hoped that such practice would become the normal mode of planning in the near future, with a view to achieve through co-operation what should obviously be impossible by acting severally.

I. C. A. R. GRANT TO CURRENT SCIENCE

ON behalf of the Current Science Association, may we take this opportunity to express our grateful appreciation of the generous gesture of the Indian Council of Agricultural Research in sanctioning to the

Association a subsidy of Rs. 2,000 each, for the years 1950-51 and 1951-52 towards the cost of printing *Current Science*?

M. SREENIVASAYA.

Secretary.

ROYAL INSTITUTE OF CHEMISTRY

THE Associateship of the Royal Institute of Chemistry is a well recognised professional qualification, being the equivalent of a First or Second Class Honours Degree of a British University. It is, therefore, a pleasure to announce that in response to many requests from India, the Council of the Royal Institute of Chemistry have decided to hold an examination

for the Associateship in Bombay in the latter half of January 1953. Forms of application for permission to enter may be obtained from the Registrar, Royal Institute of Chemistry, 30, Russell Square, London, W.C.-1, and must be returned to the same address not later than 30th September 1952.

A NEW COALFIELD IN THE SIKKIM HIMALAYA

A. M. N. GHOSH

Geological Survey of India

NEW light on the structure of the Himalaya in Sikkim and the Darjeeling District is thrown by the discovery, in the metamorphic terrain of the Lesser Himalaya in south-western Sikkim, of coal-measures of Lower Gondwana age. The rocks occur isolated from the Gondwana exposures of the southern foot-hills of the Darjeeling Himalaya and occupy an area of 40-45 square miles in the Rangit valley, about 12 miles north of Darjeeling. The Sikkim Gondwanas are exposed in the form of a window, the frame of which is provided by the older Baxa and Daling rocks lying in an inverted sequence along with the former.

Coal-bearing rocks have not been so far known to occur north of the main body of the Gondwana outcrops, stretching interruptedly along the foot-hills of the Outer Himalaya between Nepal on the west and Assam on the east where also, in the submontane region, the normal sequence of beds is reversed, the Gondwanas having been overlain by the Baxa and the Daling rocks and underlain by younger Tertiaries. It is only in the Great Himalaya in northern Sikkim that the Lachi series, considered by Wager to be equivalent to the Damuda series of the Lower Gondwana, rests in a normal sequence on the Mount Everest limestone series, which is correlated with the Baxa series of the Outer Himalaya. The Mount Everest limestone series in its turn rests on the Mount Everest pelitic series, which is considered to be equivalent to the Daling series lying much further south in the Sikkim and the Darjeeling Himalayas.¹

The Rangit valley coal-measures consist of light and dark grey, gritty and feldspathic sandstones, carbonaceous slates and semi-anthracitic coal and have at their base tillite and varved slates in which are embedded various sizes of rounded, elliptical and semi-angular pebbles and boulders of gneiss, granite, quartzite, phyllite, chert and limestone. A thick pebble bed of this nature has been recorded by Wager in his Lachi series at a height of over 18,000 feet above the sea level.² At various times and at various places a similar pebble bed has been observed at the base of the Gondwanas of the Outer Himalaya. The 'pebble bed' is now generally regarded as equal to the glacial Talchir boulder bed at the base of the Lower Gondwana beds

of the Indian peninsula.³ The widespread unconformity at the base of the Himalaya Gondwanas is not, therefore, in conformity with the suggestion that the Dalings represent a metamorphosed portion of the Gondwanas.⁴

At one place north of Namchi, at a height of about 5,500 feet the 'pebble bed' yielded *Spirifer* and fragments of other Permo-Carboniferous marine brachiopod and bivalve casts and shells. It may be recalled that Wager has recorded *Spirifer* and other Permo-Carboniferous marine fossils in his Lachi series.⁵ The presence of *Spirifer* amongst the marine fossils near Namchi suggests a southerly transgression of the Lachi sea in Permo-Carboniferous times.

A number of coal seams have been traced, some for a few feet and others over tens of yards, both on hilltops as well in the beds of the Rangit river and its tributaries, suggesting that the reserves are fairly large. The thicknesses of the seams vary from four feet to nearly twenty-five feet. Compression has rendered the coal hard and stony at places while shearing has rendered it flaky, powdery and soft at others. Vitrain bands in the coal have a shiny metallic appearance like graphite. Proximate analysis of samples of coal collected from different localities yielded the following variation of the percentages of moisture 3.14-6.31, volatile matter 6.40-11.84, ash 15.34-24.92, and fixed carbon 59.78-70.30. The Fuel Ratio ranges between 5 and 10 and is within the limit obtained in the case of the Gondwana coals elsewhere.⁶ The coal-measures are traversed by mica-lamprophyre sills and dykes, which have been subjected to considerable alteration by serpentinisation. Where they have cut the coal seams the coal has been converted into a natural coke. Similar dykes and sills are present in the Raniganj and Jharia Coalfields as well as in those of the Outer Himalaya. So far no such basic intrusions have been noticed in the Tertiary rocks of the Outer Himalaya in the Darjeeling District. There is also evidence of the existence of a post-Damuda granite in the Rangit Valley, where Tertiary rocks are absent altogether.

All around the coalfields the sequence of the rocks is inverted, the older beds resting on the younger. Owing to multiple folding and overturning of the beds the sandstone, slates,

coal and tillite as well as the older Baxa and the Daling rocks are found at all heights in the valley sections. Coal seams are present near the summit of a ridge at an elevation of 5,600 feet or over as well as in the bed of the Rangit river at about 1,000 feet above the sea level. The amount of dip ranges between 15° and 80°, although usually it lies between 30° and 45°. The direction of dip varies from east to north-east on the eastern and from west to north-west on the western side of the Rangit river. Such variation in dip and strike of the inverted strata is due to transverse folding of a gigantic recumbent anticlinal structure.

In a number of isolated sections along the foot-hills of the Darjeeling Himalaya striking examples of the overturning of folded Gondwana beds as well as of quartzites of an older age are noticeable. These sigmoid folds indicate that both the Gondwanas and the older schists and gneisses were simultaneously involved in the post-Gondwana orogenic movements that folded the rocks together first, and later overturned them. It appears, therefore, that the Himalaya in Sikkim and Darjeeling is formed by the rolling of pre-Tertiary formations into overfolds and the piling of gigantic recumbent

folds one upon another. So far two such overfold units have been recognised, one comprising the large nappe of the Darjeeling Hills in the south and the other the para-autochthonous recumbent fold of south-western Sikkim on the north. Such structural interpretation is in agreement with the feature observed in the metamorphic rocks of the Lesser Himalaya in Sikkim and of the Outer Himalaya in the Darjeeling District where, as a result of post-metamorphic folding highly metamorphosed rocks rest on less metamorphosed ones indicating an inversion of the isograds.⁷ It is only at the northern limb of the earth flexure that the normal order of superposition of the beds is present in the Great Himalaya, where a gradual vertical uplift imposed a gentle to moderate northerly dips to the metamorphic rocks and the Upper Palaeozoic and Mesozoic rocks of the Tethyan geosyncline.

1. "Everest 1933," 1934, 335 and *Rec. Geol. Surv. Ind.*, 1939, 74, 186.
2. *Rec. Geol. Surv. Ind.*, 1939, 74, 175-78.
3. *Ibid.*, 1935, 69, 155.
4. *Quart. Journ. Geol. Min. and Met. Soc. Ind.*, 1947, 118.
5. *Pal. Ind. (N.S.)*, 31, Mem. 1, 1-19.
6. *Curr. Sci.*, 1943, 15, 347.
7. *Proc. Ind. Sci. Congr.*, 38 Session, Pt. 3, 111.

PROMOTION AND SAFEGUARDING OF THE INTERESTS OF SCIENTISTS IN INDIA

ONE of the objects for which the National Institute of Sciences of India was founded was the promotion and safeguarding of the interests of scientists in India.

At the Annual General Meeting of the National Institute, held on 5th October, 1951, at Delhi, attention was specially invited to this aspect of the work of the Institute. It was pointed out then that, although the number of scientists has increased in recent years, the quality of an average Indian scientist appears to have deteriorated, and its cause was attributed to lack of "scientific atmosphere". Official procedures, social or economic conditions seem to have contributed to this downward tendency. As a matter of fact, when science is receiving great attention in India, the scientist, as an individual, is perhaps being neglected.

To study the causes of the above and to re-

port on matters that will conduce to the promotion and safeguarding of the interests of scientists in India, a Fact-Finding Committee was appointed by the Council of the Institute in January, 1952. To facilitate their work, this introductory note is published with the object of focussing the attention of scientists to this matter. Scientists are, therefore, requested to communicate their views to Dr. S. L. Hora, 1, Park Street, Calcutta. It is not intended to take up any individual cases, but specific cases might be given to substantiate a point of view.

It may be noted that all information collected in response to this note will be treated as strictly confidential and will be utilized only for formulating proposals. It is hoped that all will co-operate in communicating their views on this matter of vital importance to scientists in India.

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BOND MOMENTS AND INDUCED
MOMENTS

For the calculation of the magnitude of the induced moments in the non-polar parts of a molecule caused by induction from a primary dipole Groves and Sugden¹ outlined a method which was later applied by Thomson² in elucidating the structure of methyl and ethyl carbonates from their dipole moments. Recently Gent³ has used this method in discussing the dipole moments of dimethyl ether and other ethylene oxide homologues. It is the object of the present note to discuss critically certain assumptions involved in the derivations of Groves and Sugden and to modify their equations in order to achieve more consistency with available data.

Following Frank⁴ the induced moment μ_{ind} along the axis of the primary dipole of moment

μ for an atom or group of volume δv is given by $\mu_{\text{ind}} = [\delta V (\epsilon - 1)/4\pi] [\mu (3 \cos^2 \theta - 1)/\epsilon_0 r^3]$. (1) The component of the induced moment normal to the axis of the primary dipole is given by $\mu_{\text{ind}} = [\delta V (\epsilon - 1)/4\pi] [\mu (3 \sin \theta \cos \theta)/\epsilon_0 r^3]$, (2) where ϵ = intra-atomic dielectric constant, ϵ_0 = intra-molecular dielectric constant, θ and r refer to the polar co-ordinates of the centre of the atom or group. In order to arrive at an expression for δV Groves and Sugden used the relation $\delta V = \frac{M}{N \cdot d}$ obtained in the following manner.

$$\frac{R}{N} = \frac{\epsilon - 1}{\epsilon + 2} \cdot \frac{M}{N \cdot d} = \frac{4}{3} \pi a$$

or

$$\delta V = \frac{M}{N \cdot d} = \frac{4}{3} \pi a \cdot \frac{\epsilon + 2}{\epsilon - 1} \quad (3)$$

where R/N denotes the refraction of the atom or group and a its polarisability. It will be

easily seen that the value of δV thus obtained does not represent the volume of an atom or group but includes "free space" as well. Since it is essential in the application of Groves and Sugden's method to assume the atom or group concerned to be a sphere of uniform polarisability we may write $\delta V = 4\pi/3r_a^3$, where r_a is the radius of the atom or group as the case may be. Substituting this expression for δV in equations (1) and (2) and following the same procedure as outlined by Groves and Sugden, we get

$$\mu_{is} = \frac{\epsilon-1}{3\epsilon_0} \cdot \Sigma A_s \frac{r_a}{\pi r_s^2} \quad (4)$$

and

$$\mu_{iy} = \frac{\epsilon-1}{2\epsilon_0} \Sigma A_s \frac{r_a}{\pi r_s^2} \quad (5)$$

where ΣA_s , ΣA_y and r_s have the same significance as given by Groves and Sugden. The equations for μ_{is} and μ_{iy} obtained here differ from those of Groves and Sugden by a ratio $\frac{\epsilon-1}{\epsilon+2} \frac{r_a^3}{a^3}$. For $\epsilon=2$, this ratio becomes $\frac{r_a^3}{4a^3}$.

A very significant failure⁵ of the equations of Groves and Sugden has been in the evaluation of the bond moments of C—O and C=O (2.30 D and 2.28 D respectively). Using the equations derived here the values of these bond moments have been evaluated from the dipole moments of dimethyl ether, methyl alcohol, acetone and acetaldehyde. The results are set out below.

C—O Bond moment		C=O Bond moment	
Dimethyl ether	1.57 D	Acetone	2.42 D
Methyl alcohol	1.07 D	Acetaldehyde	2.27 D

In the calculations of the bond moments of C—O and C=O given above, a value 0.4 D for the C—H bond moment has been taken. It will be seen that the equations derived by the author for the values of the induced moments in atoms or groups assumed to be spheres of uniform polarisability yield consistent results. It is also to be noted that, in general, the values of the induced moments obtained by the present method are much less than those obtained by the method of Groves and Sugden and thus the values of the bond moments differ accordingly. In many cases, as for example, those considered here, it is clear that the bond moments calculated by the present equations vary in different molecules. This is only to be expected if one takes into consideration the variations of

the distribution of charges and length of a bond in different molecules. Despite the obvious limitations of any treatment of the induced moment problem, it is clear that the present method is quite satisfactory on account of its internal and external consistency.

The author's grateful thanks are due to Prof. R. S. Krishnan for his kind interest in this work.

Dept. of Physics,
Ind. Inst. of Science,
Bangalore-3,
June 12, 1952.

P. T. NARASIMHAN.

1. Groves, L. G. and Sugden, S., *J. Chem. Soc.*, 1937, 1992. 2. Thomson, G., *Ibid.*, 1939, 1118. 3. Gent, W. L. G., *Trans. Faraday Soc.*, 1949, 45, 1021. 4. Frank, F. C., *Proc. Roy. Soc.*, 1935, 152A, 171. 5. Sutton, L. E., *Chem. Soc. Ann. Reports*, 1940, 37, 54.

RUSSEL EFFECT AND PHOTOGRAPHIC EMULSIONS

As mentioned by the author in two previous notes,¹ extremely long exposures ranging from 24 to 48 hours were found necessary to obtain tolerably clear 'Russel Images' on the photographic emulsion used. The present note reports the results of a study of Russel effect, using different types of photographic emulsions.

The following types of photographic plates were tried: (1) Infra-red process; (2) HP3; (3) Special rapid panchromatic; (4) Rapid process panchromatic; (5) Selochrome; (6) Chromatic; (7) Zenith supersensitive; (8) Special rapid; (9) Process; (10) Fine grain ordinary.

The results obtained were surprisingly interesting. In the case of the infra-red process plate and the different types of panchromatic plates (2, 3 and 4), no impression was recorded on the emulsion. In the case of the two orthochromatic plates (5 and 6), faint impressions without any details, very similar to fog, were obtained. With the non-colour sensitive plates (7, 8, 9 and 10), however, the images were both clear and sharp.

The results of the experiments show: (1) The action exerted by wood on photographic emulsions seems to be of a purely chemical nature, and cannot be said to depend on the photographic speed of the emulsion employed. (2) The addition of certain dyes to extend the spectral range of sensitivity of the emulsion and increase its speed appears to retard the action and even stop it. It seems probable that the oxidising substances responsible for the photographic

activity either attack the sensitising dyes in preference to the silver salts or exert no action on the silver salts in the presence of these dyes.

In the light of the above, it seems difficult to support Russel's contention² that extremely fast plates have to be used to obtain perceptible effect without unduly long exposures. The activity can best be studied by using the so-called non-colour-sensitised plates or emulsions, viz., plates or emulsions, sensitive only to the blue and shorter wave-lengths.

It is found that the interposition of a very thin sheet of mica or glass stops the effect completely. From this Russel draws the conclusion that the observed action is not a case of radio-activity. It is a well-known fact that radioactive emanations affect all types of plates and the absence of any perceptible effect on orthochromatic and panchromatic emulsions is additional evidence that Russel effect is not due to radio-activity.

The action is found to be exerted through filter-paper, and even ordinary paper, and also when the plate is separated by a short distance from the surface of the wood specimen. From these, it seems safe to conclude that the oxidising substances responsible for the activity are in the form of gases or vapours.

The author is grateful to the authorities of the Pachaiyappa's College for facilities afforded him to carry out this investigation.

Dept. of Physics, V. P. NARAYANAN NAMBIYAR.
Pachaiyappa's College,
Chetput, Madras,
May 23, 1952.

1. Narayanan Nambiyar, V. P., *Curr. Sci.*, 1949, 18, 284; *Ibid.*, 1951, 20, 190. 2. Russel, W. J., *Proc. Roy. Soc.*, 1897, 61, 424.

STELLATE TWINNING IN CORDIERITE*

SIMPLE, polysynthetic (or lamellar), and sector twinning in cordierite are of common occurrence and descriptions are not lacking in literature. Some reference to stellate forms of twinned cordierite¹ are also found, but it is not quite definite whether it is used synonymously with sector twinning (yielding trillings and sixlings) or not, as no detailed descriptions or figures are given.

This is to place on record the occurrence of a twinned cordierite which has the form of a

twelve-pointed star noticeable in basal sections under crossed nicols. Similar twins do not appear to have been described or figured so far. Dittler and Kohler² have, however, described an allied form of a twin of synthetic cordierite with twelve sectors built by twelve radiating and alternating (110) and (130) twin planes extending to the periphery.

While examining some specimens of para-lavas collected by Sir Lewis Fermor from the Bokaro coalfield in 1916, a specimen (23/952) described as a "sillimanite-cordierite-labradorite vitrophyre" was noticed to contain some cordierite crystals showing very beautiful stellate twins. Fermor³ has previously recorded cordierite crystals showing normal interpenetration twins from these rocks. The rock is seen to consist of pseudohexagonal crystals of cordierite, rosettes of labradorite laths, rhombic pyroxene and some magnetite embedded in a dark to light brownish grey glassy ground-mass showing signs of devitrification. It is believed that these para-lavas have been produced by the fusion and recrystallisation of the sedimentary strata associated with the coal seams when the latter caught fire and burned.

The cordierite crystals in this rock vary in size from 0.05 mm. to 1.0 mm. and the larger crystals show numerous branching outgrowths towards the periphery (described as hexagons with tentacles or multiple terminations⁴) which is seldom bounded by straight and plane surfaces. The grains of cordierite show-

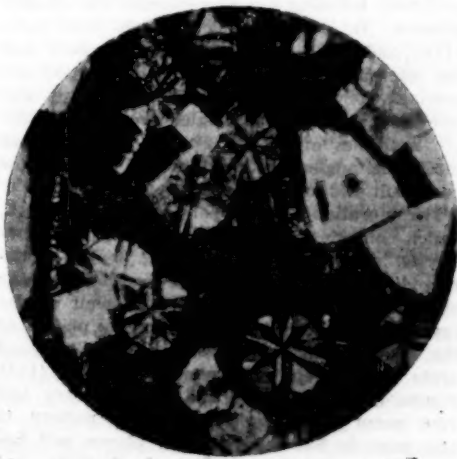


FIG. 1. Star-shaped twins of cordierite in para-lava. Crossed nicols, $\times 48$.

* Published with the permission of the Director, Geological Survey of India.

ing the stellate twins occur as smaller grains measuring 0.13 mm. to 0.3 mm. Such twins are also commonly seen in the cores of the larger irregular crystals. Fig. 1 shows some of the stellate twins of cordierite in the rock as seen in a microsection under crossed nicols.

The twins are formed by a set of 12 radiating twin planes spaced at 30° to one another (Fig. 2). About halfway towards the periphery

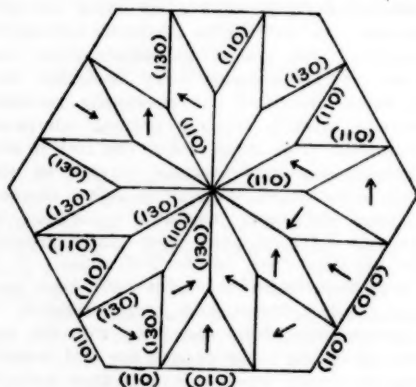


FIG. 2. Detailed diagrammatic representation of a stellate twin.

each of these twelve twin planes bifurcate making angles of 30° with the original course and these secondary twin planes meet at the periphery building a twelve-pointed star-shaped pattern. It is interesting to note that both (110) and (130) twin planes are present and the alternating ones in the central portion are similar. It will be seen that when two like twin planes meet, the angles are 60° or 120° (or multiples of 60°) but when unlike planes meet, the angles produced are 30° or 90° (or odd multiples of 30°).

The vibration direction of the slow ray or Z, which coincides with the b crystal axis in cordierite, is shown as arrows in Fig. 2. The vibration directions Z and Y have been the means of identifying the twin planes as well as the crystal faces forming the bounding planes of the pseudo-hexagonal prism in the twinned grain. A different arrangement with the (130) planes in the place of the (110) planes and vice versa producing an identical pattern is also possible but the bounding planes will become (100) and (130) instead of (010) and (110). Such cases, however, have not been found among the twinned grains studied.

The cordierite twins examined are not exactly identical with the perfectly geometric pattern shown in Fig. 2 as some portions are ill-developed and the external hexagonal boundary is seldom well defined; but the general angular relations and pattern is essentially the same. A different pattern of twinning is often seen in cordierites which have grown to larger sizes around a central core of a stellate twin. Apart from these striking stellate twins a few other patterns are also met with in twinned cordierites.⁵ A detailed study of twinning in cordierite from rocks of different Indian localities is expected to be published soon.

Geological Survey of India, V. VENKATESH.
27, Chowringhee,
Calcutta-13,
April 17, 1952.

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SOME N¹-N²-DISUBSTITUTED GUANIDINES

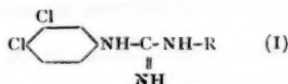
DURING the progress of research on chemotherapeutically active substances, King and Tonkin¹ discovered that p-tolyl-guanidine nitrate had a slight retarding action on a sporozoite-induced infection of *Plasmodium gallinaceum* in chicks. A large number of aromatic and aliphatic guanidines were then synthesized by the same authors, the most active among them being p-anisyl-guanidine nitrate.

The discovery of Paludrine by Curd and Rose² led them to synthesize a large number of substituted diguanides related to Paludrine, but carrying various mono- and poly-halogenophenyl groups in place of p-chloro-phenyl.³ It was noted that the 3:4-dihalogeno-derivatives were the most effective and especially the 3:4-dichloro-compounds showed markedly higher suppressive activity (roughly 5-10 times) on malarial infections than the corresponding members of the p-halogeno-series.

It was, therefore, thought worthwhile to prepare guanidine derivatives of the type (I) carrying 3:4-dichlorophenyl group at N¹-position and having alkyl-, aryl-, or sulpha-substituted residues at N²-, and to study their pharmacological properties. Accordingly, 3:4-dichlorophenyl cyanamide (m.p. 134°C .) was prepared

by a modification of Pierron method,⁴ and reacted with some aromatic and aliphatic amines, as well as some sulphoamides in pyridine medium and the following 12 compounds have been isolated and characterised.

TABLE



Sl. No.	R	m. p. °C. (uncorrected)
1	Phenyl	135-136
2	<i>p</i> -Chlorophenyl	161-162
3	<i>p</i> -Bromophenyl	175-176
4	<i>p</i> -Iodophenyl	173-174
5	<i>p</i> -Tolyl	150-151
6	<i>p</i> -Anisyl	107-108
7	3:4-Dichloro-phenyl	173-175
8	3:4:5-Trichloro-phenyl	168-169
9	Methyl	153-155
10	2-Butyl	92-94
11	Sulphanilylguanidyl	113-115
12	Sulphanilyl (hydrochloride)	185-186

All the compounds were crystallised in the form of small, shiny, white needles or long plates from water or dilute ethanol. These compounds are awaiting pharmacological investigations.

Further work on substituted guanidines is in progress. Full details of the present work will be published elsewhere.

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THE MECHANISM OF THE CONDENSATION OF ETHYL ACETO- ACETATE WITH RESORCINOLS

AHMED AND DESAI¹ had suggested that, in the condensation of ethyl acetoacetate with resorcinols, in the presence of acid catalyst, the reactive hydrogen, which is in the ortho position to the hydroxyl group, co-ordinates with the carboxyl oxygen of the acetoacetate and the addition product then undergoes dehydration and cyclisation. However, in the acidic medium, most of the acetoacetic ester should be expect-

ed to be present as enol and the reasons why sulphuric acid should give 7-hydroxy coumarins and anhydrous aluminium chloride should give 5-hydroxy coumarins,² when there is an electron attracting group in the 4 (or 6) position (I) in the resorcinol nucleus, are not given.

The suggestion of Robertson and co-workers³ that substituted cinnamic acid is formed as an intermediate has experimental support and so looks more plausible, but the mechanism of its formation was not suggested.

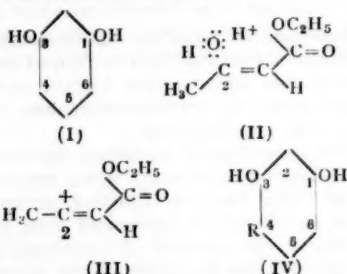
Shah and co-workers^{3,4} explained the formation of 5-hydroxy coumarin, when resorcinol substituted with electron-attracting group in the 4 (or 6) position is condensed with ethyl acetoacetate in the presence of anhydrous aluminium chloride, on the basis of the assumption that the chelation between the hydroxyl hydrogen and the oxygen of the substituent group requires the fixation of the double bond in the benzene nucleus between the carbon atoms bearing these two groups and the substitution occurs at the carbon atom joined by the double bond, to the carbon atom linked to the hydroxyl group.⁴ However, on the basis of this view, the role of the catalyst in the condensation, and the reasons why other catalysts, such as sulphuric acid, give different results, are not explained. The validity of the view of complete fixation of the double bonds has also been considered to be doubtful.^{5,6,7}

When a compound containing unshared electrons is treated with an electrophilic reagent, it is considered that the carbonium ion may be set free as a transitory reaction intermediate or may be transferred to a new linkage without actually being liberated, depending on the experimental conditions of the reaction; the driving force in either case being the affinity of the electrophilic reagent for the unshared electrons.

A double bond at the seat of substitution should inhibit the bond fission between HO and C₂ carbon atom (II) of acetoacetate ester (cf.⁸), due to the induced electromeric dis-

placement $\text{C}=\text{C}-\text{OH}$; on the other hand the electrophilic reagent would tend to pull the electrons away from the C₂ carbon atom and thus tend to break the bond between OH and C₂ carbon atom. It is suggested that when the condensing agent is an electrophilic reagent such as a proton (derived from sulphuric acid, for example, which has loosely bound protons, (II) may be obtained but when a stronger

electrophilic reagent such as anhydrous aluminium chloride is used the carbonium ion (III) may be formed, from acetoacetic ester. Then the carbon atom C_2 being electrophilic, would seek the ring carbon atom with greatest electron density in the resorcinol nucleus.



When an electron repelling group such as OH group is attached to the ring carbon atom of the benzene nucleus, the ring on the whole is activated due to resonance, the *ortho* and *para* acquiring a greater electron density, and among the two, the *para* substitution is mostly favoured.⁹ Hence (II) or (III) should attack the carbon atom at 4 (or 6) position in the resorcinol (I) resulting in the formation of substituted cinnamic acid as the intermediate, which on ring closure with elimination of alcohol molecule, would give 7-hydroxy coumarin. This would be in agreement with the experimental evidence that the condensation of acetoacetic ester and resorcinol gives 7-hydroxy coumarin irrespective of the nature of the condensing agent.²

When an electron-attracting group such as nitro or carboxy group is attached to the ring carbon atom of the benzene nucleus, the ring on the whole is deactivated, the deactivation effect being more for the *ortho* and *para* positions.⁹ It has also been mentioned² that an electron-attracting group attached to 2-carbon atom (I) has a lesser deactivation effect than when an electron-attracting group is attached to carbon atom at 4 position (or 6). It, therefore, follows that when an electron-attracting group is attached to carbon atom at 4 position, the deactivation should be more at 6-position than at 2-position. Hence, the attack of the entity III (when anhydrous aluminium chloride is the condensing agent), should be predominantly on the carbon atom at 2-position. This would give 5-hydroxy coumarins. But when the attacking entity is (II) or similar (when the condensing agent is an electrophilic reagent such as the proton derived from sulphu-

ric acid) the consideration of the geometry of II and IV would indicate that the attack on carbon atom at 2-position would be inhibited) due to steric requirements and hence the attack would be predominantly on the carbon atom at 6-position, which would give 7-hydroxy coumarin, in agreement with the experimental evidence.²

The authors wish to thank Dr. R. C. Shah for helpful comments.

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CO-PRECIPITATION OF COBALT WITH CHROMIUM HYDROXIDE

It has been observed by the author that during the qualitative analysis of cobalt chromate most of the cobalt in solution and quite often all of it is precipitated together with chromium in the third group when ammonia is employed as the reagent for separation. Cobalt has been observed to co-precipitate with $Al(OH)_3$ by Blum¹ and its co-precipitation with $Fe(OH)_3$ has been studied thoroughly by Kolthoff and co-workers.^{2,3} There is no mention in literature about its co-precipitation with $Cr(OH)_3$. Perhaps the only reference to entrainment by $Cr(OH)_3$ is that of Noyes, Bray and Spear⁴ who have mentioned that Zn and Mn can be carried down by $Cr(OH)_3$ in qualitative analysis. A quantitative study of the co-precipitation of cobalt has, therefore, been undertaken.

The co-precipitation of Co in presence of varying amounts of NH_4Cl has been determined by the method of Kolthoff and Overholser.² 20 c.c. of M/20 $Cr_2(SO_4)_3$ were mixed with 20 c.c. of M/10 $CoSO_4$ in a 100 c.c. volumetric flask and the appropriate amount of NH_4Cl added. The requisite amount of standard carbonate-free ammonia was then added and the

mixture made up to the mark with CO_2 -free water and well shaken. It was filtered after allowing to stand for 5 minutes and the cobalt in the filtrate estimated using oxine. Table I gives the effect of varying the strength of NH_4Cl on the co-precipitation of cobalt for an equilibrium ammonia concentration of 1N.

TABLE I

Strength of NH_4Cl	0.5 N	1.0 N	1.5 N	2 N
% Co-precipitation of Co	96.60	90.2	86.50	75.60

The Table shows that the extent of co-precipitation is extremely high even in 2N NH_4Cl . Working with $\text{Fe}(\text{OH})_3$, Kolthoff and Overholser noticed co-precipitation of only cobalt to the extent of 12.3 per cent. under similar conditions (concentration of $\text{NH}_3 = 0.9 \text{ N.}$). The co-precipitation of cobalt is found to increase with decrease in the strength of ammonia.

It is clear, therefore, that the method of separation of Fe, Al and Cr from Ni, Co, Zn and Mn in qualitative analysis by the use of a slight excess of ammonium hydroxide in presence of ammonium chloride is extremely unsatisfactory.

A detailed account of this investigation will be published elsewhere.

The author's thanks are due to Dr. S. K. Bhattacharyya, for his kind interest in the work.

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AN ANATOMICAL PECULIARITY IN RICE (*ORYZA SATIVA*)

In our attempt to classify the various rice varieties on the basis of bran layer thickness, an anatomical peculiarity, not previously reported by any worker, has been observed.

Dehusked grains were soaked in water for 19 hours, after which transverse sections by hand were cut with a razor. The sections were stained in 1% eosine and mounted in glycerine. Thirteen glutinous and ten non-glutinous

rices were used. For each variety, twelve grains, two sections from each grain and two random readings in each section were taken.

In addition to the normal aleurone layer as is found in every rice grain, in some of the grains of the above varieties there occurs a conglomeration of thickened cells towards the dorsal side in the spermoderm region. Such a patch is not seen in the ventral side (embryo side) of the grain.

No correlation could be found between the existence or size of the patch of cells and the nature of the rice grain, its colour or its quality. The patch was not invariably found in all cases, e.g., three varieties (T.56, T.90 and T.1145) do not manifest any such structure. The patch of cells respond positively to the Xanthoproteic reaction (Miller¹) and the test for protein suggested by Johansen.²

Ramiah and Mudaliar,³ while studying the process of protein formation in the rice grain, had observed that on the third day after anthesis the innermost layers of the ovarian wall contain the maximum amount of protein. On the fourth and fifth day after anthesis, as the development of the endosperm progresses, the protein starts passing towards the endosperm. On the sixth day after anthesis, the protein seems getting exhausted from the ovarian wall and it moves on to the aleurone layer (which almost starts differentiating) and the adjoining one or two layers of endosperm cells. On the basis of these observations, the following hypothesis regarding the formation of the patch seems plausible. While the protein passes from the ovarian wall to the peripheral endosperm, it may have been partially prevented from moving into the aleurone layer at the particular spot. How this happens needs investigation. The growth and development have to be followed right from fertilization to seed formation.

I am thankful to Sri. K. Ramiah for his constant encouragement during the investigation and gratefully acknowledge the technical assistance of Sri. R. Seetharaman.

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BLOOD GROUP CHARACTERISTICS IN SOUTH INDIANS

THE donors coming to the Blood Bank Section, Stanley Hospital, Madras, formed the material for the present investigation.

A₁A₂BO Groups.—The ABO groups were determined first using high titre Group A and Group B sera by means of the tile technique. The persons belonging to Groups A and AB were sub-grouped using absorbed Group B serum. Paraffin ring slides were used for these tests. 394 South Indians were tested. The distribution of the A₁A₂BO Groups is shown in Table I.

TABLE I

Group	Nc. of persons	Percentage
A ₁	74	18.78
A ₂	14	3.55
B	112	28.43
A ₁ B	21	5.33
A ₂ B	6	1.52
O	167	42.39
Total	394	100.00

The gene frequencies were as follows:
 $p_1 = 0.1266$; $p_2 = 0.0268$; $q = 0.1904$;
 $r = 0.6510$.

M-N Types.—60 people were grouped using anti-M and anti-N sera. The distribution of the various types is shown in Table II.

TABLE II

Group	No. of persons	Percentage
M	30	50
MN	23	38.33
N	7	11.67
Total	60	100.00

The gene frequencies were as follows:
 gene M = 69.2; gene N = 30.8.

Rh Factor.—132 random individuals were tested using anti-D serum containing saline agglutinins, by Landsteiner's tube method.¹ 96.2 per cent. were Rh positive and 3.8 per cent. were Rh negative.

Secretor Factor.—Saliva samples of 200 individuals belonging to Groups A, B and AB were tested for the secretion of the group-specific substances using the qualitative inhibition technique of Wiener.¹ 70.5 per cent. were secretors and 29.5 per cent. were non-secretors.

Iso-haemagglutinin titres of 100 individuals of Group A, 100 individuals of Group B and 100 individuals of Group O were determined using

the technique of Brewer.² 14 per cent. of individuals of Group A, 29 per cent. of individuals of Group B and 16 per cent. of individuals of Group O have a titre above 320. 9 per cent. of Group O individuals have a titre of 640 or above. These should be considered as Dangerous Universal Donors. It is usually said³ that the anti-A titre is greater than the anti-B titre in Group O. While this is true for 51 out of 100 individuals of Group O tested, it is found that in 31 per cent. the anti-B titre is as high as anti-A and in 18 per cent. the anti-B titre is actually higher than anti-A. This shows, in South Indians, the necessity for testing both anti-A and anti-B titres to eliminate a dangerous universal donor.

Grateful thanks are due to Dr. Mourant, Blood Group Reference Laboratory, London, for kindly supplying absorbed Group B, anti-M and anti-N sera, to the Director, King Institute, Guindy, for the supply of high titre Group A and Group B sera, and to Drs. Venkatramiah and Vareed for their guidance and help.

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VANADAMETRIC ESTIMATION OF TARTARIC ACID

It has been considered interesting to try the use of sodium vanadate for the oxidimetric estimation of tartaric acid in view of the unsatisfactory character of the existing methods. In recent years Gopala Rao and co-workers¹ reported on the use of sodium vanadate for many estimations, while Syrakomskii,² *et al.*, reported on the use of ammonium vanadate. In the method developed by the present authors, about 5 ml. of tartaric acid solution (containing about 7.5 g. of the acid per litre) is heated for fifteen minutes on a water-bath along with 5.0 ml. of a normal solution of sodium vanadate and 5.0 to 15.0 ml. of concentrated sulphuric acid. The mixture is cooled, diluted to 100 ml. and then titrated with a standard solution of ferrous sulphate to determine the unreacted vanadate. Results show that the reaction between vanadic acid and tartaric acid proceeds quantitatively according to the equation



Variation of the amount of sulphuric acid from 5 ml. to 15 ml. with heating for fifteen minutes has no material influence on the course of the reaction.

Vanadic acid (unlike potassium permanganate and potassium iodate) does not show any sign of decomposition on heating with concentrated sulphuric acid even for 2 hours. In one experiment 5.0 ml. of normal vanadate solution were heated with 15.0 ml. of concentrated sulphuric acid for two hours. The results obtained showed excellent agreement between the values of tartaric acid as determined by the vanadate and dichromate methods. The tartaric acid employed in this investigation is the Analar quality of British Drug Houses Ltd., London. The assay values agree very well with the values taken by weight.

Under the conditions of our experiments, oxalic acid is also completely oxidized by vanadic acid to carbon dioxide and water. This rules out the possibility of estimating tartaric acid in the presence of oxalic acid. We also made experiments on the oxidation of tartaric and oxalic acids by vanadic acid in dilute aqueous solution in the cold. Both the organic acids react with vanadic acid in the cold, although slowly. Hydrochloric acid should not be used in place of sulphuric acid in all the above experiments, as it has been found that vanadic acid interacts with hydrochloric acid in the cold when the concentration of the latter exceeds 4 N; even at lesser concentrations in the hot. Full details of the work will be published elsewhere.

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February 29, 1952.

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VANADAMETRIC ESTIMATION OF INDIGO AND INDIGO CARMINE

THE common method for the volumetric estimation of indigo is through oxidation by potassium permanganate to isatin. Heinsch¹ claimed that this is the best technical method available for the determination of indigotin. It must, however, be noticed that the method

suffers from a serious drawback, namely, that the reaction is not stoichiometric and requires the use of empirical reaction conditions and empirical correction factors.² Moreover, the method cannot be employed in the presence of organic matter like starch, dextrin or gum with which commercial samples of indigo are usually adulterated since they also react with the permanganate.

Our experiments show that sodium vanadate possesses advantages over potassium permanganate for the estimation of indigo while it is free from its defects. In view of the slow reaction between indigo sulphonate and vanadate, estimation by direct titration has not been found possible. The method, therefore, consists in mixing an aliquot of indigo sulphonate solution with a known excess of standard vanadate solution in acid medium and keeping till the reaction is completed as indicated by the disappearance of the blue colour; the unreacted vanadate is determined by titration with a standard solution of ferrous sulphate, after addition of phosphoric acid and diphenyl benzidine indicator. Our experiments carried out under widely varying concentrations show that the reaction is stoichiometric, two gram moles of vanadate are required for every gram mole of indigo sulphonate. The results yielded by our vanadametric method have been checked up with weighed quantities of chemically pure indigo as also with the permanganometric method using the empirical correction factor. Our results agree to within 0.5 per cent. It has also been observed that the reaction between indigo sulphonate and vanadate can be accelerated by the addition of a small quantity of oxalic acid (1 ml. of 1.0 N.) without introducing any error in the determinations.

Estimations of indigo sulphonate carried out with the vanadate method in the presence of starch, dextrin and gum have shown that these substances do not interfere whereas estimation with permanganate have yielded higher values due to the oxidation of these substances.

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T.A.N. CHANGES IN THE LEAVES OF TAMARINDUS INDICA LINN.

THE cell sap of plants belonging to Crassulaceae and of a few other succulent plants with high concentrations of organic acids is known to exhibit diurnal fluctuation in acidity—the acidity being highest in the morning and lowest in the evening. This phenomenon was first designated as Crassulacean metabolism by Bennet-Clark.¹ In his review Bennet-Clark included a few non-succulent plants also which show a Crassulacean type of metabolism, and expressed the view that all those non-succulent plants which show high enough concentrations of organic acid, possess this type of metabolism.

Tamarindus indica Linn. is a non-succulent plant of the tropics with a relatively high concentration of organic acids, the pH of the leaf sap varying from 3.1 to 3.5. The plant, therefore, falls in the acid group of plants in Small's scheme of classification.² The present study has been taken up with a view to see whether Bennet-Clark's generalisation quoted above applies to a tropical plant like *Tamarindus*.

The pH shows a decrease with increasing age of the leaf until in the oldest leaves again it increases with age. The titratable acidity of the leaf sap is expressed in terms of the Titratable Acid Number (T.A.N.) (Thomas).³ However, in the present work it is the amount in c.c. of 1/50 N. NaOH required to neutralise 1 g. of leaf tissue. The T.A.N. is lowest in the youngest leaves, increases with age and falls again in the oldest leaves. The T.A.N. of leaves of different age groups has been determined at various hours during the day and night at regular intervals. Within each age group there is little diurnal fluctuation in T.A.N., the difference between the lowest and highest values in a day never exceeding 6%. On the other hand, in plants with Crassulacean metabolism the percentage changes in acid content were usually very high, reaching as high a value as 1,280 in some.¹ Diurnal fluctuation could not be observed also in *Geranium pratense*.³ *Mesembryanthemum edule*,⁴ a species of *Sedum*⁴ and *Fagopyrum*.⁵

The T.A.N. is found to be highest in the winter months of December, January and February when the lowest temperatures of the year obtain at Waltair. *Tamarindus indica* thus does not exhibit the diurnal fluctuations observed by Bennet Clark and others in plants showing Crassulacean metabolism although it

retains some of the features of those plants, namely, increasing titratable acidity and decreasing pH with age and seasonal fluctuation in acidity.

Further details and discussion will appear elsewhere.

Our thanks are due to Prof. G. N. Ranga-swami Ayyangar and Prof. J. Venkateswarlu for their kind encouragement.

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ON THE ROLE OF TAMARIND AND CHILLI IN THE RICE DIET

TAMARIND and dried chilli in proportions usually added to the rice diet¹ have been shown^{2,3} to improve the growth rate of experimental animals. Since these supplements do not appreciably contribute to the protein, fat, carbohydrate, mineral or vitamin content of the diet, the beneficial effect was attributed to some unknown factor or factors associated with them.

In actual practice, the incorporation of tamarind and chilli in different food preparations is invariably accompanied by addition of extra quantity of salt. In their preparatory trials, Krishnamurti, et al.,³ found that to get the correct taste, salt had to be incorporated to the extent of 25 per cent. of the total solids of the soup. It appeared probable that this extra quantity of salt may have some bearing on the improved growth response as observed.

Two groups of weanling rats selected out of littermates were fed as follows: (1) on poor rice diet (98.75 per cent.) plus 1.25 per cent. of usual bazaar common salt, and (2) poor rice diet (95 per cent.) plus tamarind-chilli-salt soup corresponding to 2.5 per cent. of the diet as tamarind, 1.25 per cent. as chilli and 1.25 per cent. as salt. The rice diet used was similar to the one used by Krishnamurti, et al.,³ but without the salt. With a view to overcoming discrepancies arising out of differences in food intake, a third group of comparable rats were fed on diet (2), adopting the paired feeding technique.⁴ The average total gains in

weight (in g.) over a period of six weeks were: rice diet with added salt 31.8 ± 1.94 ; rice diet with added tamarind, chilli and salt (*ad lib.*) 31.5 ± 1.31 ; rice diet plus tamarind, chilli and salt (pair fed) 31.8 ± 2.10 . From this it would appear that the enhanced growth rate reported earlier was not due to any growth-promoting factors in tamarind or chilli and could probably be attributed to the extra salt contributed by the soup. The above finding has been further confirmed by studying the effect of 1 per cent. common salt as supplement to the rice diet.¹ Over a period of eight weeks, the average weekly growth rate of rats was: Rice diet 3.9 ± 0.2 ; Rice diet plus 1 per cent. common salt 5.1 ± 0.1 ; these values are significantly different and the difference is of the same order as reported earlier.³

Since the percentage of crude salt in the poor South Indian diet¹ as recommended by the Vanaspati Research Planning Committee is much lower than that ordinarily consumed in South India,⁵ it was of interest to find out whether this difference in growth is due to an increased intake of sodium chloride alone or the mineral impurities present in crude common salt. Hence the above animal experiment was repeated using 1 per cent. of pure sodium chloride (A. R.) instead of crude common salt. The weekly gains in weight for a period of eight weeks were: Rice diet 3.4 ± 0.28 ; Rice diet supplemented with 1 per cent. sodium chloride (A. R.) 4.0 ± 0.24 . The difference is not statistically significant.

In the experiments with crude salt the same specimen of bazaar salt was used. It contained 0.60 per cent. calcium. It has been already reported⁵ that the calcium present in crude salt is available to the human system.

From the above results it would appear that the growth-promoting effect of tamarind-chilli soup is due to crude common salt usually used for the preparation and not to tamarind and chilli. The beneficial effects of the crude salt are presumably traceable to the calcium and other mineral impurities present in it.

The crude common salt as used in most Indian homes, at any rate, in South India, is prepared out of sea-water which is known to contain small quantities of several mineral impurities in addition to calcium. The salt is admittedly variable in composition and its keeping quality varies with the impurities and particularly with the calcium and magnesium salts. If the nutritive value of the diet is influenced by the impurities, there would be need

to re-orient the method of preparation of salt so as to preserve the desirable constituents without impairing the keeping quality.

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"EARLESS", A NEW MENDELIAN CHARACTER IN RAGI (*ELEUSINE CORACANA* GAERTN.)

MORPHOLOGICAL abnormalities that behave as Mendelian characters have not been reported in Ragi (*Eleusine coracana*, Gaertn.) so far. One plant with small leafy shoots instead of the normal earheads was observed in an yield trial plot during the main season of 1951. These leafy structures developed on rachis corresponding to the spikes in a normal plant. These structures when transplanted on to pots struck root showing that the plants can be propagated vegetatively. It needs no mention that such mutations are rare in nature.

The same abnormality was also observed in the summer crop of ragi in 1952, in a large collection of ragi samples under study. The progenies of one single plant selection M.S. 6450/3 were observed to segregate for normal looking plants and those with leafy shoots in place of earheads in a regular Mendelian ratio.

It was observed that in a total population of 391 plants, there were 294 normal looking, while 97 had leafy shoots in place of earheads, showing that the counts are very close to the theoretical 3:1 ratio. The planting was done in 3 randomised plots in the field and the data obtained is given below:

		Normal		Earless	
Replication	1	..	90	34	
"	2	..	108	35	
"	3	..	96	28	
Total		..	294	97	
Expected (3:1)		..	294	98	

In a similar observation recorded by Sampath and Krishnaswamy,¹ mutation in rice behaving as a Mendelian recessive was found to be due to deficiency of two chromosomes.

Agricultural Res. Inst., K. DIVAKARAN.
Lawley Road Post, P. KRISHNA RAO.
Coimbatore, V. KRISHNASWAMY.
May 8, 1952.

1. Sampath, S. and Krishnaswamy, V., *Curr. Sci.*, 1948, 17, 271.

ISOLATION OF SAPONIN FROM THE SEEDS OF *ALBIZZIA LEBBECK* (N.O. LEGUMINOSAE)

EXTRACTION of the seeds of *Albizzia lebeck* (N.O. Leguminosae) with carbon tetrachloride gave no oil, but on working up the alcoholic extract, a white solid was obtained. Tests for alkaloids were negative. A preliminary investigation showed that the active principle obtained was probably a saponin. A number of experiments were tried to get it in pure condition. A small quantity thus obtained showed a high haemolytic activity on red blood corpuscles and responded to all the diagnostic tests for a saponin. Further work is in progress.

M. R. Science Institute, N. D. GHATGE.
Gujarat College, N. M. SHAH.
Ahmedabad.
May 5, 1952.

ACCESSORY BUDS IN SUGARCANE

RAGHAVAN² reported to have noticed multiple buds in sugarcane. This is not a new phenomenon in this grass. Such occurrences were reported and commented as far back as 1933 by Khanna.¹ Very recently as many as 5 buds were noticed in a Pusa hybrid, X 4668, a whorl of buds was observed in Hadda, an indigenous cane, and a Co. 453 developed 3-4 buds at one node.

Raghavan² further reported that only one of the multiple buds germinated while it is found that in most of the cases at Pusa all the accessory buds germinate, though the shoots arising out of them are not as healthy as those from normal setts.

The suggestion by Raghavan that micro-elements or hormones lead to the formation of multiple buds (more appropriately accessory buds) appears to be untenable. The availability of minor elements and their effects on the growing crops depend upon the pH of the soil which has been worked out in detail among

others by Truog.³ In a particular soil type, the effect of any one of the micro-elements and that too on a particular node of a crop variety is obviously ruled out. Likewise the causal agent being hormones cannot also be accepted as their specific formation in plants in the same environment is not possible. However, there is full agreement with the observations of the author that this phenomenon has no genetic significance, as has already been pointed out by Khanna.¹

The occurrence of multiple buds at a node may be taken as an anomalous structure in a cane-stalk. The interpretation of such conditions is best made on the basis of ontogenetic studies. In Angiosperms it is the rule that each leaf has a bud in its axil. The additional buds found in the same axil (as in the observation) are accessory buds. It is not necessary that all such buds must develop into shoots. Their development depends on the competition among themselves for light and nutrition. Instances are on record where more than one bud develops into shoot.

The terminal buds are very active in any plant and the lateral buds decrease in vigour and activity the further they are from the terminal bud. This is a very prominent feature in sugarcane. Lateral buds normally arise by the development of new apical meristems laterally in the terminal meristems of the mother shoot. Such meristems arise by the division of meristematic cells, or sometimes of more or less permanent parenchyma, in several planes, and form an apical growing point like that of the stem tip. Cortical and epidermal layers of cells along the sides of mother shoots are involved in the formation of such buds which thus have superficial origin from the apical meristem of the parent stalk. In the light of this background the phenomenon of apical dominance, which is very pronounced in Angiosperms may explain the possibility of multiple buds at a node in a cane-stalk. The dominant apical bud of sugarcane prevents the formation of shoots from buds further down the stalk. Likewise the growth of basal roots prevents the growth of roots further up the stem, even though the root primordia are present. If through any agency (most probably external) the apical dominance is reduced, thus arresting the development of the apical bud for some time, the primary meristematic cells are likely to protrude out at more than one place. Hence the formation of more than one bud in the axil of a leaf. When this external factor is removed

and the apical bud resumes its normal growth resulting in the elongation of cane-stalk, no such occurrences are found on other nodes. This explains why multiple buds are found only on a few nodes and not on every node on a stalk.

My thanks are due to Sri. K. L. Khanna for his active interest in the work.

Central Sugarcane Res. Station, C. THAKUR.
Pusa,

February 11, 1952.

1. Khanna, K. L., *Proc. Ind. Sci. Cong.*, 1933, p. 57.
2. Raghavan, T. S., *Curr. Sci.*, 1951, **12**, 330.
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ASSAY OF VITAMIN A AND CAROTENE IN BLOOD SERUM

BESSEY, *et al.*,¹ adopted the irradiation technique and used kerosene-xylene mixture (1:1) as solvent for the extraction and estimation of vitamin A in blood serum. It has been observed that kerosene and xylene contain organic impurities which show a characteristic absorption that changes with ultra-violet irradiation. It was found, however, that when the solvents were refluxed over metallic sodium for several hours and then distilled there was no change in absorption after ultra-violet irradiation. Xylene distilled at $138.5^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$. and kerosene distilled between 180°C .- 195°C . were collected and used in the present investigation (their respective densities were 0.8620 and 0.7736 at 27°C .).

For destroying vitamin A, Little² recommended that the range of the irradiating light should be between $310\text{ m}\mu$ and $400\text{ m}\mu$. Bessey, *et al.*, used a General Electric B-H4 mercury discharge lamp with a purple envelope; the envelope cuts off radiation above $400\text{ m}\mu$ and the soft glass tubes used for irradiating the solution cut off radiation below $310\text{ m}\mu$. In our experiment a Hanovia mercury vapour lamp (450 W) and a Woods glass were used. This filter absorbs radiation completely below $300\text{ m}\mu$ and above $400\text{ m}\mu$ with a maximum transmission (about 34%) at $365\text{ m}\mu$. When vitamin A in kerosene-xylene mixture (1:1) is irradiated in a Pyrex test-tube of 1 cm. internal diameter by this arrangement, the residual absorption gradually decreases with the period of irradiation and comes to about 6.9 per cent. at the region of maximum absorption after an hour's exposure. This has been found after repeated trials to be

nearly constant under our experimental conditions. The change in the absorption curve of vitamin A palmitate is shown in Fig. 1. Vita-

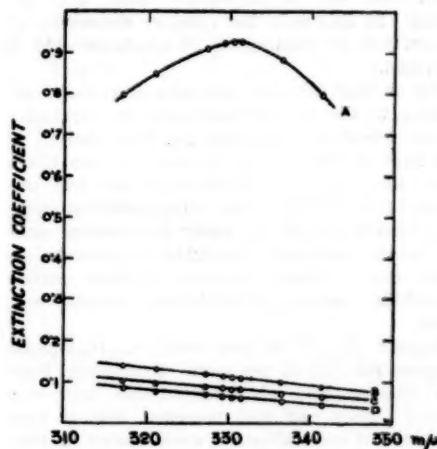


FIG. 1

Absorption curves of vitamin A palmitate in kerosene-xylene mixture (1:1) before and after ultraviolet irradiation.

min A solution was taken in Pyrex test-tube of 1 cm. internal diameter and irradiated by Hanovia mercury vapour lamp (450 W) with Woods glass from a distance of 8 cm. The lamp was turned on for 20 minutes before irradiation.

- A—Before irradiation.
- B—Irradiated for 30 minutes.
- C—Irradiated for 45 minutes.
- D—Irradiated for 60 minutes.

With the modifications mentioned above it was found that vitamin A and carotene estimations in blood serum could be carried out satisfactorily.

The Beckman spectrophotometer used in this work is the gift of the Watumull Foundation to the Government of India. Our thanks are due to them for the use of the instrument.

G. KARMAKAR,
K. RAJAGOPAL.

Dept. of Biochem. & Nutrition,
All-India Inst. of Hyg. & Pub. Health,
Calcutta,
April 15, 1952.

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ROTATORY DISPERSION OF BARIUM SALT OF REYCHLER'S ACID

IN an earlier paper¹ the rotatory dispersion of magnesium salt of Reychler's acid² was reported. In this note the rotatory dispersion of barium salt of D-camphor 10-sulphonic acid is described.

The barium salt was prepared essentially according to the method described by Graham.³ It was repeatedly recrystallised from water. It was kept at 130° in an air-oven for ten hours when the completely anhydrous salt was obtained.⁴ The substance has a high melting point. It is readily soluble in water or aqueous alcohol but is practically insoluble in absolute alcohol, ethyl acetate, benzene, toluene, carbon disulphide, carbon tetrachloride, acetone and ether.

Found: Ba = 22.87 per cent.; $C_{20}H_{30}O_8S_2Ba$ requires Ba = 22.92 per cent. Previously, Pope and Gibson⁴ had obtained barium salt with $3H_2O$. They had also recorded that it loses its water of crystallisation when heated to 130°. It was observed by the authors that the hydrated salt had a variable composition and hence completely anhydrous salt was obtained by the method described above.

It was noted that like the calcium salt⁵ of Reychler's acid the barium salt also exhibits slight fluorescence under the influence of X-rays.

The rotatory dispersion measurements were carried out in a 2 dm. tube. Rotations for wavelengths Cd 5085, Hg 5461, Hg 5780, Na 5893, Ba 6142, Ne 6402, Ba 6497, Li 6708 were measured at room temperature. The results are recorded in Table I below.

TABLE I

Concentration 2.4503 g./100 ml.; Solvent-Water;
Temperature 29° C.

Wavelength (Å)	[α] Observ- ed (O)	[α] Calculat- ed (C)	(O) - (C)
Cd 5085	.. +29.76	+28.85	+0.91
Hg 5461	.. 22.97	23.11	-0.14
Hg 5780	.. 19.57	19.57	± 0
Na 5893	.. 18.58	18.54	+0.04
Ba 6142	.. 16.38	16.53	-0.15
Ne 6402	.. 14.78	14.79	-0.01
Ba 6497	.. 13.98	14.22	-0.24
Li 6708	.. 13.18	13.09	+0.09

When the graphic analysis of the results was carried out, it pointed to a simple dispersion between wave-lengths Cd 5085 to Li 6708.

Mathematical analysis of the results shows that the dispersion can be expressed by Drude's

one-term equation, namely, $[\alpha] = \frac{4.585}{\lambda^2 - 0.09979}$

The difference of the observed values from those calculated from the equation are recorded in column four of Table I. The observed values are in good agreement with those calculated from the equation.

Authors are grateful to the authorities of the University of Saugar for research facilities.

Department of Chemistry, O. N. PERTI.

University of Saugar, S. R. K. MURTY.

Saugar, M.P.,

April 18, 1952.

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A NEW RECORD OF A HYMENOPTEROUS PARASITE, APROSTOCETUS SP.

A NEW species belonging to the genus *Aprostocetus*, sub-family Tetratichinae, family Eulophidae was discovered breeding on the pupa of *Argyria sticticraspis*, Hmps.

Preliminary experiments on the potentialities of the parasite to breed on various Lepidopterous insects were tried all these years. The parasite bred successfully on the top borer of sugarcane (*Sciropophaga* spp.), Jowar stem borer (*Chilo* spp.), Wheat stem-borer (*Sesamia* spp.), *Crociodolomia* spp. on cruciferous plants, Wax moth (*Galleria* spp.), Lemon butterfly (*Papilio demoleus*, L.), Anar butterfly (*Virachola isocrates*, F.), and *Corcyra cephalonica*, St. In these insects the pupal stage was very favourable for the parasite infestation. However, in the case of *Chilo* spp. the mature larva, before pupation was observed to be equally susceptible for the attack of the parasite. The number of parasites emerging from different insects was variable dependent on the size of the host, the smaller sized pupae providing for the development of lesser number of parasites than the bigger sized pupae.

The duration of the life-cycle ranged from 14 to 25 days depending on the prevailing temperature and humidity. The shortest duration was under an average maximum tempera-

ture of 87° F. and the minimum of 55.9° F. with an average humidity of 69.3% at 9 a.m. The longest duration of the life-cycle was under an average maximum temperature of 78.6° F. and the minimum temperature of 56° F. and 68.6 per cent. humidity.

The parasite can be easily bred on *Corcyra cephalonica*, St. The parasite appear to have great potentialities in the control of various insects which are not easily accessible to the chemical method of control. Further detailed investigations on the bionomics, life-history, mass production and the economic importance of the parasite are being completed and would be published in due course elsewhere.

The author is grateful to Dr. M. S. Mani, for identifying the parasite and to Shri K. D. Gumaste, for facilities afforded for the investigation.

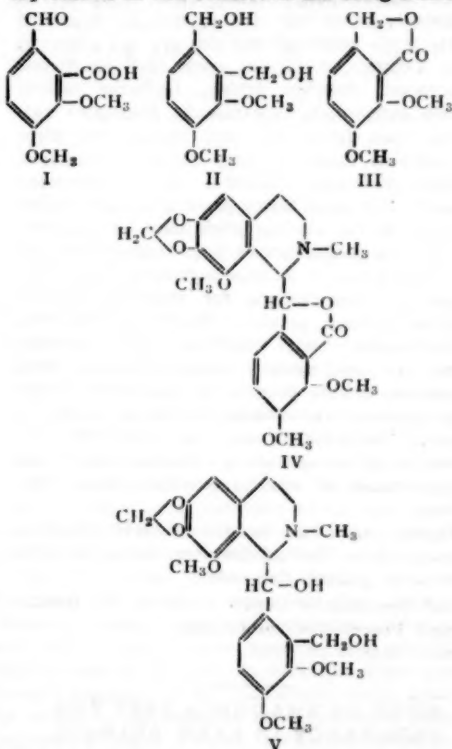
College of Agriculture, S. A. RAJA RAO.
Dharwar,
May 5, 1952.

PRESERVATION OF LACTONE RING WITH LITHIUM ALUMINIUM HYDRIDE

THE lactones are known to be reduced to the corresponding glycols with lithium aluminium hydride.¹ However, if the compound containing the lactone ring is dissolved in a mixture of ether and pyridine, the lactone is recovered even in presence of a large excess of the hydride and under conditions under which a lactone is reduced to a glycol. This phenomenon was noticed while reducing opianic acid (I) with lithium aluminium hydride in order to obtain the corresponding dimethoxyphthalyl alcohol (II). Owing to the insolubility of the acid in ether, in dioxane and in tetrahydrofuran, the acid was dissolved in the minimum amount of pyridine and then diluted with ether to the critical concentration at which the acid just remained in solution. The reduction product from such a solution proved to be meconine (III), the lactone of meconic acid. Similarly narcotine (IV), which is reduced to the glycol (V), in ether solution was recovered unchanged when reduced in a pyridine-ether solution.

It is conceivable that the lactonic compound, in presence of pyridine occurs as the pyridinium salt of the corresponding acid and the preservation of the ring is possible by the unreducibility of the salt with lithium aluminium hydride under mild conditions. This method of preserving the carboxylic group promises im-

mense potentialities for achieving selective reductions with lithium aluminium hydride and experiments in this connection are being studied.



Central Lab. for Scientific & Industrial Res.
Hyderabad-Deccan,
February 16, 1952.

RAFAT MIRZA.

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AN UNUSUAL FORM OF HAEMAG- GLUTINATION WITH CERTAIN POTATO EXTRACTS

EXAMINATION of saline extracts of various plants for haemagglutinating activity for human red blood corpuscles reveals that extracts of the common potato (*Solanum tuberosum*) contain haemagglutinins of a non-specific nature. These findings have not been reported previously. The extracts are prepared by soaking the potato overnight in an excess of water, draining off the water, adding an excess of isotonic saline, grinding in a mortar and filtering through ordinary filter-paper. Fresh ex-

tracts of certain fresh potatoes such as the Darjeeling Red Round potato produce very large agglutinates. The titre, however, is moderate, being only 128 against O, A and B cells. Such large agglutinates are not observed with extracts of various seeds such as *Ricinis communis*, *Dolichos lablab*, *Lathyrus sativus*, *Pisum sativum*, *Lens esculenta*, *Phaseolus vulgaris*, *Vicia faba*, etc., even though the titres of some of these are very high, for example, *Ricinis communis* (65,536). It is considered possible that some factor present in these tubers and not in the various seeds may be responsible for the production of large agglutinates. In this connection it is also noteworthy that extracts of other tubers, for example, *Ipomea batatas* (sweet potato), *Dioscorea esculenta* (potato yam) and *Dioscorea alata* (greater yam) do not contain hæmagglutinins, and, therefore, cannot provide confirmation of this assumption. An attempt is being made to identify the factor, if any. The information obtained may be useful in bringing about the enhancement of weak hæmagglutination reactions.

Thanks are due to the Director-General, Armed Forces Medical Services, India, for permission to publish this note.

Blood Transfusion Dept., G. W. G. BIRD.
Armed Forces Medical College,
Poona, March 10, 1952.

NOTE ON BHADURI'S TEST FOR PREGNANCY IN FARM ANIMALS

BHADURI¹ described a test for the diagnosis of pregnancy in farm animals, which consists chiefly of the injections of a faecal extract of the animal to be tested, into the male toad *Bufo melanostictus*. He claimed, that cases of pregnancy produced an emission of sperms by

the toad and presumed that this effect was possibly evoked by gonadotropic hormones excreted in the faeces of pregnant animals.

Cowie² stated that further confirmation of Bhaduri's interesting findings were needed, especially since Mitchell, Borasky and Bradbury³ found that substances having gonadotrophin-like activities were found in plants which the cattle may ingest during feeding. Cowie³ reviewing an article of Bhaduri, noted that he had failed to obtain positive response in the British toads.

Several tests were conducted in this laboratory with the faeces of pregnant, non-pregnant and the male animals on the local toads of *Bufo melanostictus*. With the exception of a very few cases, positive reactions were obtained in all the tests.

15 gm. of urine-free faeces were stirred thoroughly in 100 c.c. distilled water and kept overnight in a refrigerator. Next day the material was centrifuged and then filtered, and the process was repeated, if necessary, until a clear filtrate was obtained. This was injected, three to four times, in doses of 5 c.c. each, into the dorso-lateral lymph spaces of the male toad whose urine was previously examined for sperms, at half-hour intervals. The urine of the toad was then examined at intervals of every half-hour for ejected sperms under the microscope.

Positive reactions were first obtained in the pregnant animals and the tests were further extended to non-pregnant and male animals. The results obtained are given in Table I.

A reference was made to Dr. Bhaduri in this connection and he was kind enough to come down to our laboratory with six toads from Calcutta and parallel tests were conducted along with local toads, and the results are given in Table II.

TABLE I

Test animals	No. examined	Negative	Positive	Occurrence of positive reaction
1 Pregnant cows	18	1	17	Between 2nd and 3rd injection
2 Non-pregnant lactating cows with 2-3 months old calves	20	1	19	do
3 Sterile cows	4	1	3	do
4 Bullocks	16	4	12	do
5 She-buffaloes	10	2	8	do
6 He-buffaloes	8	3	5	do
Total	76	12	64	

TABLE II

Test animals	Hebbal Toad					Calcutta Toad						
	Injection Schedule					Injection Schedule						
	1 (5 c.c.)					1 (5 c.c.)						
	Observation in hrs.					Observation in hrs.						
	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
1 Pregnant cow	..	—	—	ϕ	—	ϕ	—	—	—	—	—	—
1 Pregnant cow $3\frac{1}{2}$ months	..	—	—	—	ϕ^*	ϕ	—	—	—	—	ϕ^*	—
1 Lactating cow with 2 months calf	..	—	—	—	ϕ	ϕ	—	—	—	—	—	—
1 Non-pregnant sterile cow	..	—	—	ϕ^*	—	—	—	ϕ^*	—	—	—	—
1 Bullock	..	—	—	—	ϕ	ϕ	—	—	—	—	ϕ	ϕ
1 Bullock	..	—	—	—	—	ϕ^*	—	—	—	ϕ^*	ϕ	ϕ^*

* Large number of sperms more than 30-40 in each field

We are led to conclude that:

- (1) Substances, similar in effect to gonadotrophic hormones, so far as they relate to the stimulation of Gameto-kinetic reaction in the male toad, are present in the faeces of pregnant, non-pregnant and male cattle. They are not confined to pregnant cattle alone as stated by Bhaduri. Their origin is not, however, clear.
- (2) It, therefore, requires further investigation to know whether such results are due to factors in the feed of the local cattle.

Our thanks are due to Dr. J. L. Bhaduri, for all his help while conducting the parallel tests in our laboratory and Dr. P. M. Narayanaswamy Naidu, under whose instructions this work was undertaken, and to Dr. L. S. Ramaswami, for having identified the toads and for his kind interest.

Mysore Serum Inst., N. S. KRISHNA RAO.
Hebbal, H. V. KRISHNAMURTHY.
Bangalore, June 10, 1952.

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** Not seen by the authors in the original.

RADIO-FREQUENCY OSCILLATIONS IN A.C. SILENT DISCHARGES

WARBURG¹ in his investigations on the A.C. discharge in Siemen's ozonizer came to the important conclusion that the A.C. discharge current through the ozonizer had components, the frequency of which was very high compared to that of the applied voltage ($\sim 10^5$ - 10^6 c.p.s.).

In investigating the Joshi Effect, Prasad² in Joshi's Laboratory devised a method in which the high frequency components of the ozonizer were picked up by an aerial and measured by means of a suitable detecting device. In the present communication we shall give direct experimental evidence of RF oscillations of discrete frequencies occurring in ozonizers and also in A.C.-operated discharge tubes, fitted with external 'sleeve'-electrodes.

Ozonizer tubes containing iodine vapour, hydrogen and nitrogen gases and also 'sleeve'-discharge tubes filled with hydrogen, chlorine and iodine vapour were excited by a suitable high voltage of 50 c.p.s. In each case there was distinct evidence of RF oscillations which could be tuned by the variable condenser of a radio receiver at some discrete frequency channels. A long vertical copper wire connected to a coil wound on each tube was used as a radiating antenna. A T.R.F. receiver or a receiver of the superhet type, worked with a receiving T-aerial was employed to detect the RF oscillations. A mirror galvanometer, with no-signal anode current balanced out, was placed in the anode circuit of the detector valve of the T.R.F. receiver (or in the anode circuit of the second detector valve of the superhet receiver). A loudspeaker at the output end after AF amplification was also used for getting the aural response.

The frequencies of the RF oscillations produced in the various discharge tubes when excited by 3,000 volts (50 c.p.s.) are given in Table I. The frequencies were obtained from the peak values of the resonance curves showing the mean rectified output current for the various positions of the tuning condenser of the receiver. As many as seven different fre-

TABLE I

Discharge tube	Frequencies of R/F oscillations (Mc/s)	Ratio of frequencies
1. Hydrogen ozonizer	.. 2.8, 4.8, 6.7, 8.6	3:5:7:9
2. Iodine ozonizer	.. 1.25, 3.5, 5.0, 7.7	1:3:4:6
3. Nitrogen ozonizer	.. 9.8	..
4. Hydrogen 'sleeve'-tube	.. 4.2, 4.9, 6.8, 8.9, 10.0, 11.9, 15.0	4:5:7:9:10:12:15
5. Chlorine 'sleeve'-tube	.. 4.2; 4.9, 6.8, 8.9, 9.8, 12.0, 14.2	4:5:7:9:10:12:14
6. Iodine 'sleeve'-tube	.. 4.2, 4.9, 6.6, 8.9, 9.8, 11.9, 14.2	4:5:7:9:10:12:14

quencies were observed in some of the 'sleeve'-discharge tubes. They appear to bear to one another a more or less simple ratio, suggesting overtones of an oscillating system.

For a given distance between the electrodes, it was found that the frequency of any one of the RF oscillations remained practically constant over a wide range of applied voltages. It was also found that for a fixed applied voltage, the frequency of the RF oscillations was independent of the distance between the electrodes.

It should be mentioned that the RF oscillations produced in the AC 'silent' discharges were modulated by the AF pulses which are now known to be associated with the Joshi Effect. It was thus possible to hear a distinct sound on the loudspeaker, when the receiver was tuned to one or another of the radio frequencies. The sound was found to increase or decrease on irradiation, according to conditions favourable for the production of positive or negative Joshi Effect. The galvanometer in the T.R.F. receiver was also able to show this photo-effect. As the RF oscillations were modulated by the Joshi Effect pulses much above 100%, the galvanometer in the superhet receiver also

could reveal the photo-effect. These experimental results will be given elsewhere.

With regard to the origin of the RF oscillations produced in the AC 'silent' discharges, it should be recalled that such oscillations in DC gas discharges were long known from the theoretical and experimental work of various investigators.³ Judging by the fact that the frequency of the RF oscillations in AC 'silent' discharges is not dependent on the magnitude of the applied voltage or on the distance between the electrodes, it appears extremely unlikely that they are of plasma-electronic origin. The origin of the observed RF oscillations in AC 'silent' discharges will be discussed elsewhere.

Wireless Laboratory, S. R. KHASTGIR.
Benares Hindu University, P. S. V. SETTY.
May 25, 1952.

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OBITUARY—DR. M. B. SOPARKAR

WE regret to announce the death of Dr. Manmohandas B. Soparkar at Bombay on May 31, 1952.

The late Dr. Soparkar was born in Poona on April 10, 1884, and was educated in Poona and the Grant Medical College, Bombay, where he took the M.D. Degree in 1913.

In 1918 Dr. Soparkar devised a special medium (Soparkar Medium) for the cultivation of the influenza bacillus. After the First World War when many Indian soldiers infected with human Schistosomes returned to India Dr. Soparkar investigated the problem of the likelihood of the disease spreading in India. He found larval forms of several trematode parasites including animal Schistosomes which he studied and described in detail.

Dr. Soparkar continued to work at the Haffkine Institute since 1914 on tuberculosis. He described the method of cultivation of the tubercle bacillus and studied the vitality of the organism under natural and artificial conditions and the channels of spread of the disease in human beings. He also studied the various aspects of animal tuberculosis. In 1935 Dr. Soparkar was appointed Assistant Director, Haffkine Institute, and worked on plague. His work includes investigations on cholera at the King Institute, Guindy, Madras. He was elected Fellow of the National Institute of Sciences of India in 1937 and President of the Medical Section of the Indian Science Congress in 1949.

K. M. SOPARKAR.

REVIEWS

Carburation (in Two Volumes, 3rd Edn. Revised). By Charles H. Fisher. (Chapman & Hall), 1951. Pp. Vol. I: xv + 356; Vol. II: xv + 279. Price 36 sh. each.

From the outset of the Development of Internal Combustion Engineering, the atomization of the fuel has been a corner-stone in the design of the engine. The controversy between carburation and fuel injection has started at an early date and pursues till this very day. It is, therefore, surprising that this subject has found so little attention in the freely accessible technical literature. One of the very few books to deal with this subject was written by Charles H. Fisher and published under the title *Carburation and Carburettor*, in 1939. This has recently been published in its third edition, and now appears in two volumes.

The first volume is concerned mainly with the theoretical background of Carburation. After a general introduction dealing mostly with the fundamental principles, the book lists the collected data on fuels, which are indeed valuable.

The two following chapters give a detailed outline of air-fuel ratios and mixture characteristics, leading to a description of general carburettor operation. In Chapter 5, the physical background of the hydraulics of carburettor is given, thus making it clear in which way a particular mixture strength is obtained and how the working of the carburettor is influenced by changes in its surroundings. Examples of the design principles of well-known carburettors are included and they are well assisted by a number of illustrations. The interdependence between the carburettor and the intake manifold system in reference to different types of engines and the manifold design is described and an account is given of the methods of testing, and the working of the carburettor in the engine. The last chapter deals with aircraft carburation and petrol injection and describes the particular and complex circumstances under which carburation has to function in aircraft power plants. The effects altitude and ising on the working of the carburettors are brought out very impressively. Due importance is given to carburettors working with injection and the general principle of injecting petrol into the inlet manifold. In the

later part of this chapter, adequate space is provided for a description of direct petrol in its general aspects and in its detailed technicalities. It is felt, however, that this new field of direct fuel injection should have called for a special chapter, since in more recent days it appears that fuel injection may have a considerable bearing on the fuel economy of the engine and especially on the increase in compression ratio. This is especially so for high powered engines, but as the examples of some new-comers in the field show, petrol injection will lead to considerable saving in fuel for very small engines, particularly for small two-stroke engines.

The second volume is meant especially for the reader with a practical outlook. It refers mainly to the installation of the carburettor and its relations to a particular engine. It deals with the methods of tuning and testing of engines on the road and on the test-bed. The apparatus necessary for those tests is described and attention is given also to the calibrating of jets. The rest of the book gives a wealth of information on construction, installation and maintenance of a number of well-known carburettor types. These data will certainly prove extremely handy. The volume concludes with the problem of automatic control of cold starting mixtures.

The first volume will be indispensable for those who seek advanced information on the principles of carburation, while the second will be very valuable to the practical engineer who is in charge of repairs and maintenance of petrol and vaporising oil engines.

H. A. HAVEMANN.

Fundamentals of Optics. By Francis A. Jenkins and Harvey E. White. Second Edition. (McGraw Hill Book Company). Pp. 647.

The book under review is an enlarged and revised second edition of the *Fundamentals of Physical Optics* by the same authors published in 1937. As the change in the title would indicate, the book now embraces the entire field of optics. It consists of three parts treating respectively with Geometrical Optics, Physical Optics and Quantum Optics.

The first part dealing with Geometrical Optics is a welcome addition and gives a systematic,

precise and lucid exposition of the fundamental principles of the subject. The chapters on thick lenses, the effect of stops and lens-aberration are particularly thorough. A large number of numerical examples have also been worked out.

The section on Physical Optics rightly occupies the major part of the book. It is substantially the same as in the first edition, but has been carefully revised with a view to improving the clarity and rigour of its presentation and to include brief accounts of recent developments in applied optics such as phase contrast microscopy, non-reflecting films, interference light filter and Schmidt Camera. Emphasis has been rightly placed on the fundamental principles as well as on the experimental aspects and practical applications of the subject.

The third part on Quantum Optics is a very brief review of the important landmarks in the photon theory of light. It is obvious that exigencies of space have prevented a fuller discussion of the quantum theory of optical phenomena. The book is characterised by lucidity which has been attained without sacrificing precision. A number of numerical examples have been given at the end of every chapter with answers for even numbered ones, which should enable the serious student to check up his understanding of the subject-matter. The book which has an excellent get-up and is superbly printed, should find a place in every Physics Library.

C. S. V.

Strain Gauges: Theory and Application. By J. J. Koch, R. G. Boiten, A. L. Biermatz, G. P. Rosz, and G. W. Yan. (Philips Technical Library), 1952. Pp. 95. Price not given.

In experimental stress analysis work, the use of variable resistance wire-strain gauges has become the most widely used technique. The book under review, the co-ordinate work of several authors, gives a concise but comprehensive description of the technique and use of the strain gauges.

The first two chapters deal with the various forms of strain gauges and the principles used in measuring and the various measuring apparatus. The third chapter deals with the fixing of the strain gauge elements and their connection to the instrument. Chapter four discusses the various factors involved in measurement, the errors that may get in, and the method of eliminating the same.

Chapter five gives in a comprehensive manner the theories of failure and evaluation of

strain measurements. The last chapter deals with the application of strain gauges and a brief description of the instruments.

The book is very useful for work in experimental stress analysis and is a valuable addition to any personal or research library.

K. SEETHARAMIAH.

1950 Supplement to Screw-Threads for Federal Services 1944. (The National Bureau of Standards, Washington, U.S.A.). Price 50 Cents.

Lack of interchangeability of screw thread parts has been a severe handicap for users of mechanical equipments in different countries. Unification of screw-thread standards was adopted by representatives of the United States, United Kingdom and Canada recently. This accord will go a long way in removing the barriers for exchange of manufactured goods. This hand-book presents the United Standards for thread forms, both coarse thread series and fine thread series in sizes from $\frac{1}{4}$ " to 4" and $\frac{1}{4}$ " to $1\frac{1}{2}$ " respectively. It also includes unified threads of special diameters, pitches and lengths of engagements. This was agreed upon subsequent to the accord mentioned above and have been formulated on the same basis as the unified standards. Wire methods of measurements of pitch diameters have been dealt with clearly and adequately in Appendix 2 of this book. Tables are presented giving the details of screw-threads which will be valuable to everyone engaged in the manufacture of bolts, screws, nuts and other threaded parts so that they may confirm to the unified standards. This supplement must of necessity be maintained by every production workshop in the country.

A. RAMACHANDRAN.

The Chemistry of Lignin. By Friedrich Emil Brauns. (Academic Press Inc., New York), 1952. Pp. 808. Price \$ 14.50.

This exhaustive monograph in 27 chapters deals with the distribution, colour reactions, isolation and determination of lignin, its physical properties and elementary composition acylation and alkylation, halogenation, nitration, sulphonation, hydrolysis, alcoholysis, mercaptalysis, phenolysis, reduction, hydrogenation and hydrogenolysis, oxidation, alkali fusion and special reactions of lignin, thermal and biological degradation, theories of the structure of lignin, linkage in the plant, forma-

tion and synthesis of lignin. It is probably the only detailed work on the subject written by one who has himself so largely contributed to the subject, and fills a long-felt want. The book is eminently readable, and as far as possible gives full details, thus saving the necessity to refer to original literature which sometimes may be hard to get at.

On page 22 the author refers to some results of Cieslar. It may be mentioned that similar results have been obtained by the reviewer, viz., decrease of lignin content with height in some conifers. The chapter on the physical properties of lignin is fairly complete. Mention of magnetic properties (vide P. Nilakantan, *Proc. Ind. Acad. Sci.*, 1938, 7 A, 38) and dielectric properties (vide Kroener, *Dissertation*, Braunschweig, 1943) would have made it more complete. In the chapter on synthetic lignins no mention is made of the synthesis of "lignin" from coniferyl alcohol with the help of a dehydrase reported by Freudenberg. Possibly the book went to the press before this work was published. A chapter on the applications and uses of lignin and on the thermal plasticisation of lignin would have been useful. Sandalwood is *Santalum album*. The common name for *Pterocarpus santalinus* is red sanders. Sometimes it is called red sandalwood (p. 139). There are a few printing mistakes in the book. Some of the structural formulæ on pages 507 and 508 also require slight rectification. Considering that the book was printed in a non-English-speaking country the errors are few. The work can be warmly recommended as a reference book to all those who have to do with the chemistry or applications of lignin.

D. NARAYANAMURTI.

Application of the Electronic Valve in Radio Receivers and Amplifiers. By B. G. Dammers, J. Haantjes, J. Otte and H. Van Suchtelen. Pp. 425. Philips Technical Library. (Published by N. V. Meulenhoff & Co., Amsterdam), 1951. Price not given.

The present volume is the work of four well experienced members of the scientific staff of the Philips Company and forms the second of the series of three books devoted to the application of electronic tubes in radio receivers and amplifiers. The authors are to be congratulated for the thoroughness with which the subject has been treated and for providing detailed information about practically every aspect of audio frequency amplification except the subject of inverse feedback. In view of the im-

portance of the latter in connexion with audio frequency amplification the appearance of the third volume which would deal with the subject is eagerly awaited.

The book is divided into three chapters. The first chapter deals with the audio frequency amplifying circuits, phase inverting stages, the frequency response, the design and characteristics of audio frequency transformers and non-linear distortion. Numerous calculations have been given for illustrating the subject-matter. The second chapter deals with various adjustments, distortion, behaviour under complex load and overload phenomena of the output stage, with a thoroughness which is highly commendable. A large number of graphs and numerous design calculations have been given to illustrate the use of different types of valves in different circuits. The treatment of the double tone method is especially noteworthy. The third chapter deals with the power supply system for the filament and the H.T. and discusses the design procedure for stabilised supply voltage for the H.T.

The clear and systematic treatment of the book makes it undoubtedly a valuable addition to the literature of the subject. This book is recommended to those especially engaged in the design work of audio frequency amplifiers.

S. K. C.

The Enzymes—Chemistry and Mechanism of Action. Edited by James B. Sumner and Karl Myrback. Vol. I, Part 2. (Academic Press Inc., New York), 1951. Pp. x + 725-1,361. Price \$12.8.

The second part of the first volume contains 24 contributions which cover some of the most important groups of enzymes. Among these are proteolytic enzymes by Emil L. Smith, urease by Sumner, the distinguished Editor, who crystallised the enzyme, Arginase by Greenberg, Carbonic Anhydrase by Roughton, the discoverer of this enzyme, Enolase by Mayerhof who found it as one of the essential components of the glycolytic system, phosphorylases with special reference to phosphorylase and synthesis of saccharides by Hassid and his collaborators, Transaminases by Cohen, Transmethylases by Sourker, Penicillinase by Abraham, Thiaminase by Harris and Nucleolytic Enzymes by Laskowski. The lesser known of the enzymes, e.g., Cellulases and related enzymes, have received attention at the hands of Pigman. Pectic enzymes have been reviewed by Kertesz, one of the pioneers

in this field. The enzymatic hydrolysis of mucopolysaccharides is reviewed by Fishman.

Enzymes responsible for the coagulation of milk and blood have received their share of attention in this volume. Particularly valuable is the contribution of Seegers who has surveyed the field of blood coagulation. Reviews devoted to a discussion of the other relatively unstudied enzymes, viz., Allantoinase and Allantoicase, Hippuricase, Histidase and Urocanase, Fumarase and Aconitase, Desulphydrases and Aspartase, will serve to highlight the problems awaiting elucidation and to stimulate further work on these rather obscure and ill-defined enzyme systems.

Twenty-six foremost workers in the field of enzymes from Europe and America have participated in the presentation of the 24 topics referred to above. This volume as the previous one already reviewed, will be warmly welcomed with appreciation and gratitude by a wide circle of investigators interested in Enzymology in its most comprehensive sense.

Adhesives for Wood. By R. A. G. Knight. (Monographs on Metallic and Other Materials, Vol. III). (Published by Chapman & Hall), 1952. Pp. 242. Price 25 sh.

This book by R. A. G. Knight of the Forest Products Research Laboratory Princes Risborough in 22 chapters deals with adhesives in general, factors in gluing technique, survey of conditions under which adhesives are used and the testing of adhesives. According to the author the purpose of the book is to "serve as a text-book for the younger technician and to provide a work of reference". The form of presentation, which differs from other books, has been guided by the author's experience in general liaison work between research and industry and in particular by the collaboration between the Forest Products Research Laboratory and the Research and Development Materials Branch of the Ministry of Supply and contains information not readily available to the general public. The book has a rather practical bias. It is written in a concise and readable manner containing useful tips and would particularly be of assistance to those engaged in gluing.

Chapters 15 to 17 on survey of conditions under which adhesives are used are not usually so exhaustively dealt with in similar books, but the departure should be welcomed as it is of great practical importance. The reviewer would agree with the author that it

is not safe to use U.F. glues for extreme service conditions.

On page 27 the author refers to the soaking of protein glues in formaldehyde. The use of protein-formaldehyde dispersions does not find a place. On page 58 "it is stated that plywood made with thermosetting glues usually undergoes a permanent compression of 5%.....". But this will vary with species, moisture content, temperature, etc. On page 59 "It is said that pressures of 400 p.s.i. lead to what are virtually starved joints". This is not always true. The chapter on the identification of the adhesive in a joint is rather meagre. In considering the effect of shrinkage on page 118 the work of Dietz and Grinsfelder could have been mentioned. On page 75 it is stated that borax and boric acid treated veneers can be satisfactorily glued with P.F. film glue. This contradicts Madison Report R 1427.

On page 93 while discussing alkalinity and acidity some examples of timbers having alkaline or acid reactions or extractives affecting glue adhesion could have been mentioned. On page 43 water-alcohol or 5% caustic soda solutions are recommended for cleaning P.F. coated surfaces. The reviewer has witnessed this for metal roller spreaders being done by high pressure live steam in a very efficient manner. The book is remarkably free from printing errors and mistakes. On page 18 last line "Ward" should be "Wood". Page 158, 2nd para, 2nd line, "adherent" should read "adherend". "Grinstead" should read "Grinsied" and "Del Monte" should read "Delmonte" wherever these names occur.

D. NARAYANAMURTI.

The Elements of Field Geology. By G. W. Himus and G. S. Sweeting. (University Tutorial Press, London. Agents: Oxford University Press, Madras-2). Pp. viii + 268. Price Rs. 11-6-0.

The book is divided into two parts; the first part consisting of ten chapters deals with the procedure to be followed when examining a district of simple structure, with or without the aid of a geological map.

Chapters IV to IX deal in successive stages with the art of geological mapping and contain valuable hints and instructions in simple and clear language of the methods of observation, recording and interpretation of geological formations and structures in the field. Chapter VIII is of particular value to students introduced for the first time to geological mapping, as gradual stages of geological survey of an area

are given in clear language with the appreciation of the difficulties that confront a novice in field work. Chapter X details the methods of interpretation of the geological data where a three-dimensional image has to be conceived from two-dimensional plans.

The second part consisting of Chapters XI to XV gives data, where possible in tabular forms, for easy identification in the field, of common minerals, rocks and fossils. These chapters will be of real value to junior students and amateur geologists for easy identification of their collections in the field which is very essential to form a correct estimate of the geology of an area under investigation. The three appendices on 'Safety Precautions', 'The Geological Column' and 'Literature Reference for Further Studies', are useful to those for whom the book is intended.

A few mistakes have crept into the text which may be corrected in the second edition: P. 24, para 3 first line under (i) a comma is helpful to prevent confusion of the meaning, after "valley". P. 88, l. 21, obviously "assimilated" is an inappropriate term. P. 57, Fig. 22, letter 'e' is missing in the name Debenham. P. 64, on the map, "fallening" is an obvious misprint for flattening. P. 106, l. 26, 'indentifiable' is a misprint for 'identifiable'. Pp. 37 and 66, lines 2 and 11 respectively, 'shaley' appears to be a misprint for 'shaly'; likewise 'platy' is spelt as 'platey' on page 124, Table E.

The book is in many respects a unique and useful addition to geological literature and is eminently suited to be prescribed as a text book for the Degree and Honours courses in Geology in our Universities. Those who wish to be amateur geologists will find it a valuable companion. The authors have done a distinct service to students of geology in bringing out this very helpful book on field geology.

C. MAHADEVAN.

"Analar" Standards for Laboratory Chemicals. (Formulated and issued jointly by the British Drug Houses, Ltd., and Hopkins & Williams, Ltd., London), 1949. Fourth Edition. Pp. xviii + 302. Price Rs. 10.

Two British firms of established reputation in the field of laboratory chemicals have jointly issued the fourth and enlarged edition of their well-known handbook of specifications of what is familiarly and widely known as Analar Reagents. They have rendered a great service to science and industry by manufacturing the reagents of specified standards, so that scientific workers could use them with confidence.

The fourth edition includes fifty-eight new Analar Chemicals which generally fall into two subclassifications: (a) reagents for inorganic analysis, including the detection and determination by gravimetric, colorimetric and other means of both metals and acid radicals, and (b) reagents for the identification of organic substances by the formation of derivatives of definite melting points.

With the development of analytical methods of greater sensitivity and increased accuracy, higher standards of purity of the reagents are demanded, and there is, therefore, a continual need for revising the Analar Standards. Microbiological assays of amino acids and the partition paper chromatography represent two such recent developments. The reagents needed for this type of analysis are far more exacting than what is furnished by the "Analar" reagents. The enlightened firm of the British Drug Houses have already in their catalogue introduced amino acids of "Microbiological Assay" quality. Even more exacting are the standards needed for chromatographic analysis. We have found that some samples of the "purest" amino acids fall far short of the standard purity needed for chromatographic purposes. The British Drug Houses and Hopkins and Williams, are continually keeping abreast of these developments and cater to the exacting requirements of the scientific men. The volume under review is not only a helpful guide to an intelligent use of the reagents but also a valuable reference book furnishing data pertaining to the physical and chemical properties of the substances with which it deals.

Thiophene and Its Derivatives. By H. D. Hartough. (Interscience, New York), 1951. Pp. i-xvii + 1-533. Price \$ 16.50.

The third volume in the series of monographs on heterocyclic compounds, edited by Weisberger, is of outstanding interest and importance. Thiophene chemistry before 1941 has been summarized in two books by Victor Meyer and by Steinkopf, and the present volume gives a complete account of thiophene chemistry, elaborating in particular the great advances made since 1945. As a result of the production of thiophene by the Socony Vacuum Company by the interaction of *n*-butane with sulphur, thiophene chemistry has been intensively studied during the last few years. Much of the recent work on thiophene and its derivatives is due to Hartough, who therefore writes on the subject with authority. The book amply fulfils its

object of stimulating interest in new uses for thiophene as a raw material for synthesis. F. F. Blicke contributes a chapter on "Biological and Pharmacological Activity of Thiophene and Its Derivatives". "Molecular Structure and Spectroscopy of Thiophene and Its Derivatives", have been discussed by F. P. Hochgesang, who includes much unpublished work carried out in the Socony Vacuum Laboratories. Chapters VI to XVI give an exhaustive treatment of the entire chemistry of thiophene and its derivatives, Chapter XIII including unpublished work of Brooks on derivatives of 3-thiophenethiol. A valuable feature of the book is the description of preparative methods for a large number of thiophene derivatives, which are of interest as intermediates for further synthesis. The physical properties of compounds are listed in tabular form throughout the book. K. V.

Citrus Products—Chemical Composition and Chemical Technology. By J. B. S. Braveman. (Interscience Publishers, New York), 1949. Pp. xiv + 424. Price \$9.00.

Citrus fruits and citrus products, by virtue of their high vitaminic and nutritional values and also by virtue of their industrial importance, have evoked world-wide interest although their cultivation is limited to certain favoured tracts of the globe. Literature available on the subject is scattered throughout scientific and technological literature and texts on the subject had grown out of date as a result of rapid advances made in this field. The volume under review represents a comprehensive and compact treatise furnishing information and data on the horticultural, chemical and technological aspects of the subject.

The volume is presented into two parts: the first dealing with the chemical composition of the constituents of the fruit and the second, describing the technological aspects of the utilisation and manufacture of citrus products. Processing of citrus juices—concentrated, frozen, sweetened and fermented juices, preparation of jams, jellies and marmalades, are some of the subjects treated in the volume. Reference is made to the manufacture of citric acid both from citrus fruits and by the fermentation method.

The author is the Director of Research of the Central Citrus Products Research Laboratory of Israel, famed for its luscious citrus orchards. The author who is entitled to speak with first-hand knowledge of the subject, has presented in this volume the accumulated experience of twenty-five years of applied work on

the utilisation of citrus fruits and their by-products.

The various methods for the utilisation of the byproducts like citrus peels and citrus pectin are described. Standard specifications for some of the citrus products, drawn up by the United States, United Kingdom and Israel, are given in Appendix II.

Advances in Genetics, Vol. IV. Edited by M. Demerec. (Academic Press Inc., New York), 1951. Pp. ix + 343. Price \$7.50.

The fourth volume in this series is a welcome addition to the literature on genetics, containing as it does nine contributions on selected topics by leaders in the particular field. There is an article on theoretical genetics "Possible significance of duplication in evolution," by S. G. Stephens. Of the remaining eight articles, three pertain to plant genetics and five to animal genetics. The special field in animal genetics 'Drosophilistics' has two articles, one on heterochromatin and the other on lethal factors. These two and the contribution on physiological genetics of the mouse by Salome Gluecksohn-Welsch pertain to the study of gene action.

For plan-breeders the article on cotton breeding by T. R. Richmond is of interest. Though it deals only with breeding of Upland cotton for the United States, the problems and techniques of cotton breeding are well discussed. The articles by Krug and Carvalho on genetics of *Coffea* and by Seijin Nago on rice genetics would prove useful, as they are based on original work and summarises publications which are not easily accessible.

The book is essential to all biology libraries. The workers on specialised aspects of genetics can easily learn of developments in other fields with the help of this series. The printing and get-up are of the usual high standard.

C. G.

Books Received

A Guide to Filter-Paper and Cellulose Powder Chromatography. By J. N. Balston and B. E. Talbot. (M/s. H. Reeve Angel & Co.), 1951. Pp. 1 + 145. Price 8 sh.

Biochemical Society Symposia No. 8, Metabolism and Function in Nervous Tissue. (M/s. Cambridge University Press), 1952. Pp. 102. Price 12 sh. 6 d.

Science and Culture. (Selection of Passages from the Writings of Sri Aurobindo and the Mother). Compiled by Indra Sen. (Aditya Karyalaya, Pondicherry), 1951. Pp. 116. Price Re. 1-8-0.

SCIENCE NOTES AND NEWS

Colour Response in Insects

Sri. A. B. Saran, N. P. Tiwary and B. N. Sahay, Botanical Section, Sabour, write as follows:

The differential response of insects to coloured lights has been reported before.^{1,2,3} Our field experiments with hurricane lanterns using different kinds of light round a set of plots which were infested with Gundhi bugs (*Leptocoris varicornis* F.) and stem-borers (*Schœnobius bipunctifer* Wlk.) show that the best result is obtained with white light. Red light proved to be very ineffective.

1. Berthoff, Lloyd M., *Jour. of Agri. Res.*, 1931, 42, 379. 2. Frisch, K. Von, *München Med. Wchnschr.*, 1913, 60, 15. 3. Imms, A. D., *Recent Advances in Entomology*, 1937.

Tata Gold Medal for Zoological Research

The Zoological Society of India will award the Sir Dorabji Tata Gold Medal for the best research done in Zoology between January 1948 to December 1951. Research workers are therefore requested to send details of work done by them during this period, with copies of reprints of papers (which will be deposited in the Library of the Society) to Dr. M. A. Moghe, Registrar, Poona University, Ganeshkhind, Poona-7.

Dr. Lal C. Verman

Dr. Lal C. Verman, Director, Indian Standards Institution, was re-elected Vice-President of the International Organisation for Standardisation (ISO) at the annual meeting of its Governing Council at New York.

Travancore Monazite Factory

The monazite factory set up by the Atomic Energy Commission of India in Travancore is expected to go into production shortly and will produce rare earth compounds, trisodium phosphate, crude thorium hydroxide and dilute caustic soda solution. Another factory for the production of uranium and thorium compounds is proposed to be set up shortly. This factory will be self-supporting and will meet its operating cost through the sale of its thorium compound to the indigenous gas mantle industry.

Raw materials used by the factory will be uranium-bearing ores located by the rare

minerals survey unit of the Commission and thorium-uranium-bearing residues of the Indian Rare Earths Ltd., Alwaye.

International Mathematical Union

Plans for an International Mathematical Union were discussed at the International Congress of Mathematicians held in Cambridge, U.S.A., in August-September, 1950. Of the participants from India, Professor D. D. Kosambi was elected a member of the preparatory committee. The IMU has now been constituted, adhering countries forming national committees. The first General Assembly which was held in Rome recently elected for the period 1952-54 Professor M. H. Stone (U.S.A.), President and Professor Bompiani (Italy), Secretary; the office will be at 22, Via Verona, Roma, Italy.

The first activities of this new Union will be the preparation of a World Directory of Mathematicians, the re-establishment of the International Mathematical Instruction Committee and the publication of a news bulletin. The Union will also devote its attention to the problem of abstracting and reviewing and the publication of a polyglot directory of mathematical symbols. It will give all possible support to the next Mathematical Congress scheduled for Amsterdam in 1954.

Standard Nomenclature for Pest Control Products

A standard list of coined common names has been issued by the British Standards Institution for established pest control products, embracing insecticides, insect repellents, acaricides, nematocides, fungicides, herbicides and rodenticides. These names do not conflict with proprietary names, but are intended for common use to assist users in the identification of the active ingredients of pest control products having otherwise cumbersome technical names. It is emphasized that these names are in no way proprietary, but in order to pre-empt as far as possible their availability as common names they have been recorded, though not registered as Trade Marks, by H.M. Patent Office.

Copies of this standard (B.S.1831; Part I, 1952) may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W. 1, Price 2/6.

Photo-Sensitised Glass

Using a special photo-sensitive glass that is opaque, Corning Glass Works, have developed a photo-chemical etching technique that would appear to have many applications in the fields of lighting, photo-engraving and electronics. A trace of silver compound is used to make the glass photo-sensitive. The operator places an ordinary photographic negative on the photo-sensitive glass and exposes it to the ultra-violet light. The glass, which still appears clear, is then placed in a high-temperature furnace. Oven-heating at approximately 1,200° F. for about an hour causes a milk-white image to appear, caused by crystallization of certain elements in the glass.

Recognition of A.P.T.I. Diplomas

The Government of India, in consultation with the Union Public Service Commission, have decided to recognise the All-India Senior Diplomas in Commerce, Engineering and Chemical Engineering and Technology awarded by the Association of Principals of Technical Institutions, India, in 1945, as equivalent to corresponding University Degrees for purposes of recruitment to posts under the Central Government.

Award of Research Degree

The University of Poona has awarded the Degree of Doctor of Philosophy in Chemistry to Sri. S. S. Pathak for his thesis on "Studies in Hydrogenated Fats with Special Reference

to Toxicity of Nickel and Nutritive Value of Iso-oleic Acids."

Free Flow of Information Materials

An International agreement, the first to come into operation under UNESCO's sponsorship, seeks to eliminate customs duties on books, newspapers, magazines, paintings and sculpture. Also exempt are travel literature, musical scores, manuscripts and articles for the blind. Free import is likewise granted to educational films and filmstrips, newsreels, sound recordings and other audio-visual and scientific equipment. These materials, however, are exempt only if consigned to recognised institutions such as libraries, schools, universities, research laboratories, museums and broadcasting organizations.

Substitutes for Nickel

Shortage of nickel for electroplating is being met in Australia by the use of speculum (55 per cent. Cu, 45 per cent. Sn), bronze (90 per cent. Cu, 10 per cent. Sn), tin-zinc (80 per cent.—20 per cent.) and white brass (80 per cent. Zn, 20 per cent. Cu) as substitutes.

Electro-Chemical Society, India Section

At the Second Annual Meeting of the Section held on June 27, 1952, the following Officers were elected for 1952-53: *Chairman*: Professor M. S. Thacker, Bangalore; *Vice-Chairmen*: Charat Ram, Esq., Delhi, and Mr. K. Rajagopal, Mettur Dam; *Secretary-Treasurer*: Mr. J. Balachandra, Bangalore.

ATOMIC ENERGY AT HARWELL*

THE first official account of research work done during the last five years by the Atomic Energy Research Establishment at Harwell has been released in book form under the title 'Harwell'. The book gives an account of the research establishment from its inception to its present status, a review of the isotope reactor and accelerator programmes, a full treatment of health hazards and protective measures, fundamental research and arrangements for extramural work. In addition there are four appendices, including a glossary and list of papers already published and an index.

Much information is given on the direction

which medical research is taking in its attack on diseases hitherto intractable by orthodox methods. Of the industrial possibilities of atomic energy, some of the most interesting and valuable material is contained in the chapter recounting progress in fundamental research. While much of the chemical and physical investigation is specific to metals and compounds mainly encountered in atomic processes, some of the techniques devised have led to advances such as the accurate analytical detection of minute traces of various elements. Of special interest is the chapter on the metallurgy of uranium and its alloys, the investigation of which is of the highest importance for the development of better fossil fuel elements.

* Issued by H. N. Stationery Office, London. Price 6s. 6d.